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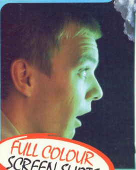

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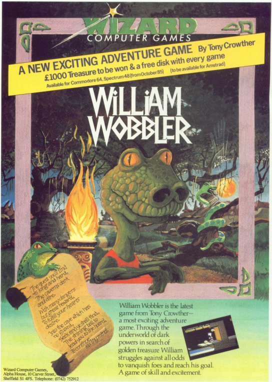
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**VOLUME 2**
**NUMBER 3**
**DECEMBER 1985**

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Five C128s to be won in our jig-saw competition.

# DATA STATEMENTS

## Hordes of Henries

ENGLISH SOFTWARE HAS JOINED THE pre-Christmas rush to release compilations and brought out Henry's House and Friends, Volumes 1 and 2.

Each tape contains four titles including Henry's House, Jet-Boot Jack, Stranded, Neptune's Daughters and Soldier of Fortune, the only previously unreleased title.

Each retail at £6.95 and are available from English Software, 3rd Floor, 1 North Parade, Parsonage Gardens, Manchester M60 1BX.

VOLUME TWO
C64
C128
HENRY'S HOUSE
SOFTWARE

VOLUME ONE
C64
C128
HENRY'S HOUSE
NEPTUNE'S DAUGHTERS
STRANDED
SOFTWARE

## Wizards and Wars

US GOLD HAS TWO NEW RELEASES IN the shops.

The Wizard and the Princess is the second release in US Gold's All American Adventure series and features the Wizard Harlin who has done the usual dirty deed of kidnapping a princess and imprisoning her in a tower. Your task – to rescue her.

The game is available on disk or cassette at £14.95 and £9.95 respectively.

Doughboy features a little soldier in the trenches who tries to collect the supplies scattered around, of course there are enemy troops and fire to avoid on the way. It also costs £9.95 on cassette and £14.95 on disk and US Gold can be contacted at Unit 10, The Parkway Industrial Centre, Heneage St, Birmingham B7 4LY.

## £25,000 richer

MATTHEW WOODLEY IS THE WINNER of Domark's £25,000 prize for completing Eureka! and finding out the secret telephone number to claim his prize.

Matthew phoned the number four times before he had the courage to leave his name because he was too shy to speak to the answer phone.

The game was translated into French and German so thousands of people all over the world have been trying to win the prize. Domark co-founder, Mark Strachan said: "When the solicitor rang to tell me that the prize had been won, I nearly fell off my chair! Matthew has beaten everybody to it and we are all delighted for him."

Lloyds Bank

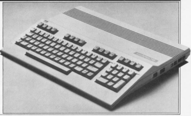
## 128 and 1571 for £500

THE NEW COMMODORE 128 COMputer is to be offered complete with a disk drive for £499.99.

The Commodore 1570 is a single handed 0.5 Megabyte 5¼ inch floppy disk drive designed specifically for the 128. However, it is fully compatible with all other Commodore home computers.

The drive supports sequential, relative and user files in Commodore Standard format, with 340K formatted storage capacity.

Explaining the rationale behind the package, Commodore's marketing manager, Chris Kaday said: "In order to get the best out of the 128 and run CP/M effectively, a de facto industry standard 5¼ inch disk drive is needed, so we have decided to subsidise part of the cost involved. At £499.99, the result is one of the most competitive small business systems on the market."



## Wash 'n' Wipe

FED UP WITH ALL THOSE SCRATCHED out labels on your old cassettes? Want to really smarten up your program collection. Warnes Wipers reusable labelling kits could the answer to your prayers.

For a mere £1.49 you can buy 12 labels plus a wipers pen from Warnes Wipers, 23 Werter Rd, London SW15 2LL or from selected high street stores.

Write 'n' Wipe
Write 'n' Wipe
wipers

## Hewson Game on 64

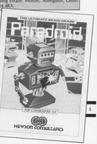
HEWSON CONSULTANTS HAS RECently released a new game for the C64 entitled Paradroid.

The player find himself in an intergalactic freighter using an Influence Device to suppress a mutinous android crew.

Full colour high resolution graphics depict 20 decks on the freighter, which is equivalent to 400 screens, according to Hewsons.

Andrew Hewson said: "We're bringing our original games style to Commodore owners and they're liking it."

The game costs £7.95 and is available from Hewson Consultants, 56B Milton Trading Estate, Milton, Abingdon, Oxon OX14 4RX.



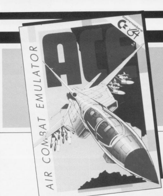
## Scooby Doo Where Are You?

ELITE IS RELEASING A COMPUTER GAME version of the ever popular television cartoon series, Scooby Doo.

Elite describes the game as "the first ever computer cartoon". The game features Shaggy and Scooby trying to unravel the mysteries of Murdoch Castle.

The game is entirely graphic and uses speech bubbles for communication. Steve Wilcox, Elite's sales director said: "The best comparison we can draw is with the lazer disk games, the player's role is very much as the director of an interactives cartoon."

The game is out now and costs £7.95. Elite can be contacted at Anchor House, Anchor Road, Aldridge, Walsall WS9 8PW.

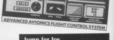


## Air Ace

ACE — AIR COMBAT EMULATOR, A program which was originally released for the C-16 is now available for the C64.

Manufacturers, Cascade Games, claim great things for the title. According to Cascade you can feel what it's really like to fly a high performance military jet with the smoothest, fastest and most detailed cockpit view yet seen on micro. There are views of hills, trees, tanks SAM sites, helicopters, ships and enemy aircraft, all in 3D.

The Emulator is priced at £9.95 and Cascade's address is 1-3 Hayward Crescent, Harrogate, North Yorks HG1 5BG.



## Log On Please

ACTIVISION HAS ANNOUNCED A NEW game which brings the world of hacking that much closer to the average, honest computer user.

Hacker is a new game which allows the player to stumble into someone's computer system. You have absolutely no idea who the system belongs to or what its function is but you realise that its important to find out these things.

The only message you get to start you off is "Log on please". After that you must fend for yourself.

There is no instruction booklet, no rules and no clues. You're completely on your own and eventually realise that your actions in this situation could help save the world. Again!

Activision is at 15 Harley House, Marylebone Road, London NW1.

## Llama League

LLAMASOFT AND ARIOLASOFT ARE joining forces to market new Llamasoft releases.

The first game to be affected by the deal is Batalyx, previewed on the Llamasoft stand at the PCW show. Priced at £12.95 on disk and £9.95 on cassette it features six sub-games to keep the player engrossed.

Ashley Gray of Ariolasoft commented: "We're delighted to be working closely with one of the UK's leading computer games software houses. Batalyx is one of the best arcade and strategy mix games to be released and it's a guaranteed chart buster."

## Thousands Attend Show

ATTENDANCE FIGURES AT THE PCW show broke all records this year.

Over five days more than 63,000 visitors arrived to view the latest in software and hardware.

Glen Powell, director of organisers Montbuild Limited, said: "This is the largest attendance at any computer event in the UK, and the business audience is greater than for any of the other specifically business computing shows."

The ninth Personal Computer World show will again be held at Olympia from 3-7 September 1986.

## Jump for Joy

CONGRATULATIONS TO THE 40 winners of our Anirog competition which appeared in our August issue. They will each be receiving a copy of Anirog's C64 game, Jump Jet.

Paul Couchman, Stapleford: Frank T Bedford, Prittlewell: Carl Keller, Haupstra, W Germany: Andrew Kinnesley, Bunbury: Simon Waites, Kilburn: Derek Tumman, Woodstock: Richard Sirr, Drumcliffe: C De Haan, Rotterdam: ER Clarke, Bridgend: Philip Wood, Poynton: T J Stallard, Kingsbury: Glen Harrison, Bewdley: Brian Buckly, Shaw: Robert Moswquemo, Epsom: Ron Pearson, Kettering: Anne Blair, 92 Squadron, Wildenrath: Samantha James, London: ER Turrell, Great Yarmouth: AC Rees, Pembroke Dock: P Wake, London: Sean McGovern, Hindley: Craif McFarlane, Bearsden: Tony McGarrigle, Co Derry: Maureen James, Durham: David Aitchson, Dalmellington: M Ramsden, Grimsby: D Woods, St Helens: Mark Hopkins, Redditch: Ian C Small, High Wycombe: Andrew Smith, Brixworth: Steven Juby, Scarborough: Alexander Zwart, Breugel, Holland: Thomas Watson, Winsford: Richard Jeffrey, Castle Donnington: AG Pereira, London: Patti Taylor, Wimborne: Darren Harris, Rathfarnham: Philip Vincent, Hastings: Rachel Fox, Abertillery: Peter D Bewes, Bolton-le-Sands, S Brehaut, Eastleigh: J Crane, Liverpool.

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| Gemini — Cashbook (with nominal analysis) | d | £64.95 |
| Gemini — Cashbook (with nominal analysis) | c | £59.95 |
| Gemini — Final Accounts | d | £64.95 |
| Gemini — Final Accounts | c | £59.95 |
| Gemini — Cashbook/VAT/Final Accounts | c | £89.95 |
| Gemini — Cashbook/VAT/Final Accounts | d | £99.95 |
| Ramtop — Accounts Package | d | £75.00 |
| Studio — Payroll 64 | d | £49.95 |
| Dell — Invoice Generator II | d | £24.95 |

**Stock Control systems**

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| Practicorp — Inventory 64 | d | £29.95 |
| Gemini — Stock Control | d | £24.95 |
| Gemini — Stock Control | c | £19.95 |
| Anagram — Stock Control | d | £75.00 |

**Home applications**

| | | |
|---|---|---|
| Gemini — Home Accounts | c | £19.95 |
| Gemini — Home Accounts | d | £24.95 |
| Gemini — Combined Home Pack | d | £39.95 |
| Gemini — Combined Home Pack | c | £34.95 |
| Fieldmaster — Home accounts | d or c | £19.95 |
| Adamsoft — Checkbook Manager | d | £14.95 |

**Database Filing Systems**

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|---|---|---|
| Handic — Diary 64 | r | £19.95 |
| Fieldmaster — Mail label | d | £29.95 |
| BI — The Consultant | d | £125.00 |
| Practicorp — Practifile 64 | d | £44.50 |
| Precision — Superbase 64 | d | £87.00 |
| Precision — Superbase Starter | d | £39.95 |
| Gemini — Database | d | £24.95 |
| Gemini — Database | c | £19.95 |
| Gemini — Mailist | d | £24.95 |
| Gemini — Mailist | c | £19.95 |
| Fieldmaster — Record Card | d or c | £19.95 |
| Dell — Superfile | d | £14.95 |
| Practicorp — Practicalc 64 | d | £44.50 |
| Practicorp — Practicalc II | d | £69.95 |
| Supersoft — Busicalc 1 | d or c | £17.95 |
| Supersoft — Busicalc 3 | d | £49.95 |
| Fieldmaster — Worksheet | d,f or c | £19.95 |

**Spreadsheets**

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|---|---|---|
| Handic — Easy Calcresult | r | £49.95 |
| Handic — Advanced Calcresult | r + d | £90.00 |

**Word Processors**

| | | |
|---|---|---|
| B.I. — Paperclip 64 | d | £90.00 |
| Simple — Simply Write | d | £46.00 |
| Simple — Simply Write | c | £40.25 |
| Hesware — Heswriter | r | £42.95 |
| Fieldmaster — Pagewriter | d or c | £29.95 |
| Bank Street Writer | d | £69.00 |
| Precision — Superscript | d | £69.95 |
| DTL — Wordcraft 40 | r | £69.95 |

**Utilities**

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|---|---|---|
| Adamsoft — Ultrabasic | d | £19.95 |
| Adamsoft — Cadpack 64 | d | £35.00 |
| Adamsoft — Chartpak 64 | d | £24.95 |
| Adamsoft — Superdisk | d | £12.50 |
| Adamsoft — Graphics Designer | d | £19.95 |
| Audiogenic — Forth 64 | r | £29.95 |
| Blitz compiler | d | £50.00 |
| Fieldmaster — Poster printer | c | £19.95 |
| Handic — Mon 64 | r | £34.95 |
| Hesware — Forth 64 | r | £59.95 |
| Commodore — Simons Basic | r | £47.50 |
| Kuma — BC Basic | r | £57.50 |
| Practicorp — 64 Doctor | d | £19.95 |
| Supersoft — Master 64 | d | £71.30 |
| Supersoft — Victree | r | £56.35 |
| Supersoft — Mikro Assembler | r | £59.80 |
| Supersoft — Zoom monitor | d | £14.95 |
| Supersoft — Toolkit 64 | c | £9.95 |
| Supersoft — Toolkit 64 | d | £11.95 |
| Aztec — Turbo extended basic | c | £14.95 |
| Activision — The Designer's Pencil | c | £11.99 |
| Jetpack compiler | d | £39.95 |
| Jetpack compiler | c | £14.95 |
| FP — Pascal 64 | d | £34.95 |
| Oasis — Basic Lightning | c | £14.95 |
| Oasis — Basic Lightning | d | £19.95 |
| Oasis — White Lightning | c | £19.95 |
| Oasis — White Lightning | d | £29.95 |
| Oasis — Machine Lightning | c | £29.95 |
| Oasis — Machine Lightning | d | £39.95 |
| Talent — Panorama | c | £17.95 |
| Talent — Panorama | d | £19.95 |
| Skyles — 1541 Flash kit | r | £89.95 |
| Epyx — Fast load | r | £49.95 |
| Reston — Moviemaker | d | £65.00 |
| Access — Mach 5 fast loaders | r or d | £39.95 |
| Orpheus Pascal | c | £24.95 |
| Broderbund — The Printshop | d | £44.95 |
| Broderbund — Printshop graphics designer | d | £29.95 |

**Simulations**
**Flight simulators**

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| Microprose — Solo Flight | c or d | £14.95 |
| Sublogic — Flight Simulator II | d | £49.95 |
| Sublogic — Flight Simulator II | c | £42.95 |
| Supersoft — Interdictor Pilot | d | £19.95 |
| Supersoft — Interdictor Pilot | c | £17.95 |
| Activision — Space Shuttle | c | £11.99 |
| Cosmi — Super Huey (helicopter) | c | £11.95 |

**War**

| | | |
|---|---|---|
| SSI — Cosmic Balance | d | £44.95 |
| SSI — Germany 1985 | c or d | £59.95 |
| SSI — Operation Market Garden | d | £64.95 |
| SSI — Battle for Normandy | c or d | £14.95 |
| SSI — Geopolitique | d | £44.95 |
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# IN ARCADIA

**A bulging mail bag has given Flippo plenty of reading matter this month. Read on to meet the ghostbusting experts.**

ONCE MORE INTO THE BREACH, DEAR friends. Hey, sorry I've been absent, but a lot of things have been happening. I went on my hols (even an arcade wiz has to take a break sometime!) and as well as that I've had a pile of mail from you guys that would choke a cow. So, enough chewing the cud, let's chew into the mailsack.

## Ghostbusted!

Since I spoke to you last, I've had a big wodge of mail about *Ghostbusters*, taking up the challenge to beat the $1,000,000 mark. Hmmm! Well, it didn't take you long, so here is the upshot of all your scores.

| Name | Acc. no. | Score |
|---|---|---|
| Tai Ling Wu | 31722246 | $999,990 |
| Stephen Auernigg | 31662346 | $999,990 |
| Kevin Cheetham | 31222346 | $999,990 |
| Alec Harkness | 27102314 | $311,700 |
| John Tollervey | 40014104 | $126,000 |
| John A. Morrison | 31663446 | $999,900 |
| Phil Truscott | 31023046 | $999,900 |
| Chris Rogers | 27714115 | $365,700 |
| Simon Holden | 31222646 | $999,900 |

Phew! What a great showing from my beloved readers! Well, guys and gals, I'm proud of you. Here's what some readers added to their hi-scores.

Miss Tai Ling Wu, Edgbaston: "I'm afraid I have bad news for Chris Rogers of Rhyl, his hi-score has been broken. My next goal is to become an Elite!" Happy shooting, Tai Ling!

Kevin Cheetham, Newcastle Upon Tyne: "Here is my hi-score...does this make me a mega-ghostbuster?" Could be, Kev!

Alec Harkness, Newbury: "I am also trying for the $1,000,000 mark, so if Chris Rogers reads this, I challenge him to a race to get that amount of money..." Here that, Chris?

John A Morrison, Sheffield. "I reached this figure a couple of months ago, and since I could go no higher, I stopped playing. I always used the 1963 Hearse and ignored the marshmallow sensor."

Phil Truscott, Oldham: "This score was achieved over about four months. The score mentioned by David Crane ($999,999) must be wrong, as the last two digits are always 00". Ok, so I misquoted him, so shoot me... (BANG! AAaaaaa!)

Chris Mansell, Gloucester: "I tried typing a $18,000 code into the computer. Instead of the $18,000 it gave me this: $999,999. Over one million! When I tried to use it again it told me very rudely there was no such account number!" Dash it!

Simon Holden, Belgium. "I devised several rules for adding together account numbers, which enabled me to increment my score from $20,000 to $60,000 in one go. The rules are quite complex, but one of the simplest, to add £10,000, is add one to the third digit, and add two to the fifth. This will work especially when the fifth digit is less than six." It's cheating, Simon, but I love it! Full marks!

## Impossible Mission?

In Arcadia regular, Chris Rogers wrote to me about *Impossible Mission*. "I believe I have done the impossible with *Impossible Mission* — I have completed it without losing a life! It took 29 mins 52 secs, giving me a score of 30708!" Nice one, Chris. How about sending us a few tips on how to finish the game? I'm sure there are a lot of folks out there who would love to join you in the hi-score table. Well, everyone except Stephen Auernigg. He says "My highest score is 30560, i.e. not one life lost on *Albatross*. The other pass words I have completed are Alligata, Cormarant, Crocodile, Asparagus, Artichoke, Butterfly...and I think the one I'm working on is called Swordtail." Hmm! No problems there, I think. Except I think the password you're looking for is Swordfish!

Other hi-scores this month are:

| | |
|---|---|
| Chris Wharry, Co Antrim | |
| Exploding Fist | 213800 |
| Terry Bailey, MidLothian | |
| Boulder Dash | 34768 |
| Zaxxon | 175700 |
| Pitfall II | 145238 |
| Pole Position | 107600 |
| EJ Lloyd, Shevington, Wigan | |
| Raid Over Moscow | 864000 |
| Hunchback II | 478300 |

So, that's the mailbag. Thanks a million for all your letters; keep them coming, because as you know, this is your column too!

## Fave Raves

Games I've been playing in the last few months include: *Rockford's Riot — Boulder Dash II*, *Summer Games II*, *Archon II*, *Sky Fox*, *Spy Vs. Spy II*, and I still can't leave *Elite 64* alone yet; a whole lot of new stuff... OK, so most of them are sequels to previous chart successes, but in all cases they are better than the originals, with zippier graphics and more complex game-plays. I'll be featuring tips from all these games as and when I can sort them all out.

Oh, by the way, I've been waiting for a letter from you, about your favourite game. I've got one from everyone else, where's yours? It's OK, but don't let it happen again!

## News...News...News

*Rescue On Fractalus* and *Ball Blazer* are the first two releases, on the Activision label, by Lucasfilm Games, the computer games wing of the movie company that brought you Star Wars, Raiders of the Lost Ark and all their sequels. The games are brilliant. The graphic quality of these games really makes them stand out as coming from the George Lucas stable, and I confortably predict they will become firm favourites. I've heard a whisper that the next release from this firm will be the most advanced computer game on the 64 ever made...but then again, aren't they always?

# OUT NOW by JEFF MINTER

# BATALYX

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# MASTERING THE C-16

This month Joe Nicholson deals with sound commands on the C-16.

## Sound

THIS CHAPTER EXPLAINS how to operate the C-16's two channel sound generator outside the standard SOUND and VOLUME commands. First we deal with the control registers and then go on to discuss interrupt driven sound.

### The Registers

**Volume** — Bits 0-3 of address 65297 ($FF11) are used to control the volume. It will accept all numbers between zero (off) and 15 (max). However values from eight to 15 are all maximum volume. Bits four to six of this register must remain unchanged, so to set the volume in Basic the following instruction is necessary:

```
POKE 65297,(PEEK(65297)AND
240)+VOLUME
```

To set the volume to five in machine code use these instructions:

```
LDA   $FF11
AND    $F8
ORA    $05
STA   $FF11
```

**Channel Select** — The three voices are selected by bits four and six of the register at 65297 ($FF11) as follows.
Bit 4 (the 16's bit) selects voice 1 for music (1 on,0 off).
Bit 5 (the 32's bit) selects voice 2 for music (1 on,0 off).
Bit 6 (the 64's bit) selects voice 2 for noise (1 on,0 off).

All other bits must remain unchanged, therefore to set voice 1 to music and voice 2 to noise enter:

```
POKE,(PEEK(65297)AND143)=
64+16
```

Or in machine code:

```
LDA   $FF11
AND    $8F
OR     $50
STA   $FF11
```

**Sound reload value** — Bit seven of address 65297 controls the sound reload value. When this bit is set, sound is cut off in a way similar to VOL 0, until the bit is reset. This bit is used in the C-16 SOUND command when changing notes and appears to be the reason why there is an audible 'click' between notes — both sound channels are turned off momentarily between notes.

To turn the sound reload 'on', i.e. disable sound, use:

```
POKE 65297,PEEK(65297)AND
127
```

In machine code:

```
LDA   $FF11
AND    $7F
STA   $FF11
```

**Note:** As all the POKEs dealing with volume, channel select and sound reload are all to the same address, it is possible to set up all three with a single POKE.

e.g.: POKE 65297,55

Which resets the sound reload bit, selects voice 1 and voice 2 to music, and volume to seven.

Or try: POKE 65297,0

which resets the sound reload bit, turns off voice 1 and voice 2, and sets the volume to zero.

**Frequency: Voice #1** – the frequency is held in a 10 bit number. Address 65294 ($FF0E) contains bits zero to seven and address 65298 ($FF12) holds bits eight and nine. It is important that bits two to seven of register 65298 remain unaltered when setting bits zero and one. For example, to set the frequency of voice #1 to 516:

```
POKE 65298,(PEEK(65298)AND
252)+2
```

to set the multiples of 256 — for 516 there are two multiples hence the +2. Then

POKE 65294,4 to set the remainder.

In machine code:

```
LDA   $FF12
AND    $FC
ORA    $2
STA   $FF12
LDA    $04
STA   $FF0E
```

**Frequency: Voice #2** – The address 65295 ($FF0F) contains bits zero to seven, and bits zero and one of address 65296 ($FF10) hold bits eight and nine of the frequency of voice #2. Unlike voice #1, bits two to seven of register 65296 do not have to remain unaltered, hence to set the frequency of voice #2 to 516,

```
POKE 65296,2 and
POKE 65295,4
```

| Address | Hex | Function |
|---|---|---|
| 1276 | $04FC | voice 1 low byte duration |
| 1277 | $04FD | voice 2 low byte duration |
| 1278 | $04FE | voice 1 high byte duration |
| 1279 | $04FF | voice 2 high byte duration |
| 65294 | $FF0E | voice 1 frequency bits 0-7 |
| 65295 | $FF0F | voice 2 frequency bits 0-7 |
| 65296 | $FF10 | voice 2 frequency bits 8-9<br>bit 0 is bit 8 of frequency<br>bit 1 is bit 9 of frequency |
| 65297 | $FF11 | bits 0-3, VOLUME 0-15<br>bit 3 sets max volume<br>bit 4 select voice 1<br>bits 5 select voice 2 music<br>bit 6 select voice 2 noise<br>sound reload (1 enable, 2 disable) |
| 65298 | $FF12 | voice 1 frequency bits 8-9<br>bit 0 is bit 8 of frequency<br>bit 1 is bit 9 of frequency<br>make sure other bits are not changed when altering frequency |

In machine code:

```
LDA    $02
STA   $FF10
LDA    $04
STA   $FF0F
```

**Duration** — the duration is controlled by the IRQ (interrupt request) to be explained later. The duration of each voice is controlled by two registers each incrementing once per frame, or 1/50 of the second, until they both reach zero when that voice is turned off.

**The registers:**

voice #1: 1276 ($04FC) low byte,
1278 ($04FE) high byte.
voice #2: 1277 (04F1) low byte,
1279 ($04FF) high byte.

The general equation for each voice is therefore,

A = 65536 - no. of 1/50ths second.
POKE low byte,A–(INT(A/256)*256)
POKE high byte,INT(A/256)

In machine code (assuming the duration is not 255 jiffies i.e. 5.1 sec):

```
LDA   no. of frames
EOR    $FF
STA   low byte
LDA    $FF
STA   high byte
```

If the number of jiffies exceeds 255 then the following routine should be used:

```
SEC
SBC    $00
SBC   low byte of duration,
      1/50ths sec
STA   low byte result
LDA    $00
SBC   high byte of duration
STA   high byte result
```

The various functions of the control registers are summarised in Figure 1.

```
START: 10000  ;PLAY COMMAND
 10010  ;(SINGLE CHANNEL)
 10020  ;(C)1985 JOE NICHOLSON
 10030  ;
 10100  ;TURN ON..
 10110  ORG $600
 10200  :ON SEI
 10210  LDA #$24
 10220  STA $314
 10230  LDA #$06
 10240  STA $315
 10250  LDA #$FF
 10260  STA $04FC
 10270  STA $04FE
 10280  CLI
 10290  RTS
 10300  ;TURN OFF..
 10310  :OF SEI
 10320  LDA #$0E
 10330  STA $0314
 10340  LDA #$CE
 10350  STA $0315
 10360  CLI
 10370  RTS
 10500  ;PLAY CONTROL..
 10510  ORG $624
 10600  :PL LDA $04FC
 10610  CMP #$FF
 10620  BEQ R:P2
 10630  :P5 JMP $CE0E
 10700  :P2 LDY #$00
 10710  LDX #$00
 10720  :P3 LDA ($D0),Y
 10730  STA $D2,X
 10740  :P4 INY
 10745  INX
 10748  TXA
 10750  CMP #3
 10760  BNE R:P3
 10770  LDA $D0
 10780  ADC #2
 10790  STA $D0
 10800  BCC R:PA
 10810  INC $D1
 11000  :PA LDA $D2
 11010  CMP #$FF
 11020  BNE R:P6
 11030  JSR :OF
 11040  :PB CLC
 11050  BCC R:P5
```

```
 11100  :P6 CMP #$FE
 11110  BNE R:P7
 11113  LDA $D0
 11116  STA $D5
 11120  LDA $D3
 11130  STA $D0
 11140  LDA $D1
 11150  STA $D6
 11160  LDA $D4
 11170  STA $D1
 11180  CLC
 11190  BCC R:P2
 11200  :P7 CMP #$FD
 11210  BNE R:P8
 11220  LDA $D5
 11230  STA $D0
 11240  LDA $D6
 11250  STA $D1
 11260  CLC
 11270  BCC R:P2
 11300  :P8 CMP #$FC
 11310  BNE R:P9
 11320  LDA $FF11
 11330  AND #240
 11340  ORA $D3
 11350  STA $FF11
 11360  CLC
 11370  BCC R:P2
 11500  :P9 EOR #$FF
 11510  STA $04FC
 11520  LDA #$FF
 11530  STA $04FE
 11540  LDA $FF12
 11550  AND #252
 11560  ORA $D4
 11570  STA $FF12
 11580  LDA $D3
 11590  STA $FF0E
 11600  LDA $FF11
 11610  ORA #$10
 11620  STA $FF11
 11630  CLC
 11640  BCC R:PB
>> OK.
```

## Play Command

Many commercial arcade games have a tune which plays while the game is running. This section shows how this can be done on the C-16 by using the hardware interrupt.

Every 1/50 of a second (or jiffy) the computer executes a service routine which reads the keyboard, handles the internal jiffy clock and the duration of sound. Locations 788 ($314) and 789 ($315) hold the vector pointing to this routine. To make the computer access an additional routine every jiffy, these vectors should be changed to point to the new routine which in turn ends with a jump to the service routine.

When using the PLAY command the new routine plays a series of notes from a list in memory. The routine senses when each note is finished by examining the duration registers looking for the value $FF in both registers. However, it does not wait for them to be reset and the note subsequently turned off, in order to avoid the annoying clicking sound which occurs between notes. It then switches smoothly to the new note.

Figure 2 shows a C-16 Assembler listing of the PLAY command. Lines 10100 to 10290 contain the routine which switches on the PLAY command. First it disables the hardware interrupt (SEI) to ensure that there are not interrupts while the interrupt vector values are being changed — otherwise the machine may crash. It also turns off any notes playing at that time and sets the start of the list of notes to address $3E00 (15872). The interrupts are then enabled by the CLI instruction.

The routine at lines 10300 to 10370 turns off the PLAY command restoring the interrupt vectors to the normal routine at $CE0E (52750). Lines 10500 to 10290 begin the PLAY routine by checking whether the last note has finished; if it has it gets the next note values (three bytes) from the table and after checking to see if they are special commands (e.g. to set the volume) it loads these values into the frequency and duration registers.

The complete routine can be relocated by changing the ORG command at lines 10110 and 10510 and making the switch-on routine set the interrupt vector to its new value. The internal registers used by the PLAY command are stored between $00 and $09 (208-217). As explained in the first article, this is a free area of zero page.

The list of notes is stored in

memory as follows: the first byte is the duration which may be one jiffy (1/50 sec) to 247 jiffies (about five secs). The next two bytes are the low and high bytes of the frequency which can be between zero and 1024, as for the SOUND command. This interrupt driven routine plays Voice #1, which leaves Voice #2 free to be used for additional explosions and so on.

## Instructions

The PLAY command has its own special instructions which are stored in the table being identified only by their duration values. Numbers between $FB and $FF are reserved for these special instructions.

The new commands are:

**$FC (252) volume:** This can be used to change the volume inside a tune. The low byte of the frequency contains the new volume setting, zero to eight. The high byte should be present but is unused.

**$FD (253):** This is a type of GOSUB instruction. It jumps to the address stored in the frequency bytes. Also it stores the old pointer address in memory allowing the tune to return, so that tunes can have subroutines although nesting is not allowed. This can also be used as a GOTO instruction.

**$FE (254):** This is the return instruction which makes the PLAY command resume after the last GOSUB instruction. The two frequency bytes must be present but can have any value, preferably zero.

**$FF (255):** This completely turns off the PLAY command.

Figure 3 shows a demo program playing Largo's famous Hovis advertisement! The machine code for the PLAY command is stored from line 1000 to 1100 and the data for the tune is stored from line 200 to line 260 in the form of duration and frequency values. The data is written from address $06B0 (1712). Line 100 POKEs this number into the tune pointer. The SYS 1536 at line 170 executes this routine.

It is possible to improve the performance of the PLAY command by simulating the attack, decay, sustain and release functions of a sound synthesiser. This will be explained next month.

```
100 RESTORE1000:FORA=1536TO1709:READB:PO
KEA,B:NEXT
110 POKE208,176:POKE209,6
120 RESTORE200
130 FORA=1712TO1831STEP3:READB,C
140 POKEA,B:POKEA+1,C-(INT(C/256)*256)
150 POKEA+2,INT(C/256)
160 NEXT
170 VOL7:SYS1536
190 REM
195 REM TUNE DATA
200 DATA254,1727,254,1796,254,1796,254,1
727,254,1712
210 DATA20,685,20,739,40,739,20,685,20,6
43,40,596,20,643,20,685
220 DATA20,739,20,685,80,643,20,685,20,7
39,40,739
230 DATA20,685,20,643,40,596,20,643,20,6
85,20,643
240 DATA20,596,80,596,253,0
250 DATA20,770,20,810,40,810,20,796,20,7
39,40,770
260 DATA20,770,20,810,20,798,20,739,80,7
70,253,0
990 REM
995 REM PLAY COMMAND DATA
1000 DATA120,169,36,141,20,3,169,6,141,2
1,3,169,255,141,252,4
1010 DATA141,254,4,88,96,120,169,14,141,
20,3,169,206,141,21,3
1020 DATA88,96,255,0,173,252,4,201,255,2
40,3,76,14,206,160,0
1030 DATA162,0,177,208,149,210,200,232,1
38,201,3,208,245,165,208,105
1040 DATA2,133,208,144,2,230,209,165,210
,201,255,208,6,32,21,6
1050 DATA24,144,216,201,254,208,19,165,2
08,133,213,165,211,133,208,165
1060 DATA209,133,214,165,212,133,209,24,
144,196,201,253,208,11,165,213
1070 DATA133,208,165,214,133,209,24,144,
181,201,252,208,13,173,17,255
1080 DATA41,240,5,211,141,17,255,24,144,
164,73,255,141,252,4,169
1090 DATA255,141,254,4,173,18,255,41,252
,5,212,141,18,255,165,211
1100 DATA141,14,255,173,17,255,9,16,141,
17,255,24,144,162
```

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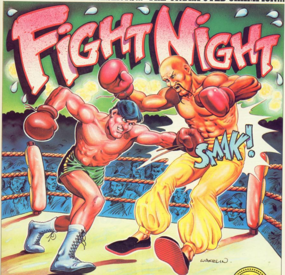

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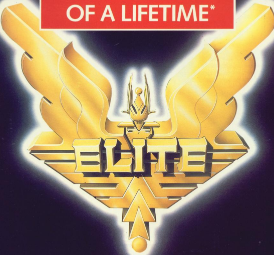

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*Zzap! 64 Magazine

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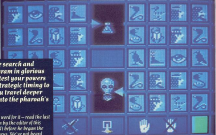

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HIGH PERFORMANCE PROGRAMS

**Iain Murray brings you an introduction to creating sprites on your C64.**

# SPRITE RIGHT

THOSE OF YOU WHO OWN C64s may be fascinated by the effects which can be created using the machine's sprite graphics features. However you may not have attempted to play with sprites yourself due to the complexity of handling them from Basic. This article is a simple tutorial on playing with sprites and takes you step-by-step through most of the functions connected with them, explaining how each works, and giving a demonstration of each stage. The demonstration is handled by a program which you type in one section at a time, adding on new features as you go.

## Creating Sprites

A sprite is a user-defined graphic block which is 24 pixels wide by 21 pixels high (a pixel is a picture element i.e. the smallest single dot available on the screen). Sprites can be moved around very easily as a block, rather than by replotting all the individual pixels. Other functions are also available, as we will demonstrate.

The pixels are arranged in three adjacent parallel columns of 21 bytes (one byte=eight bits). Each bit can be zero or one, corresponding to a pixel on or off. Thus, for example, if all bits are off, the byte will have value zero, and if all bits are on, it will have value 255 (1+2+4+8+16+32+64+128=255).

The Commodore manuals explain how to create sprites to your own designs but for our purposes, we will use a solid sprite with all bytes set to value 255. The bytes are arranged as a consecutive block in memory, and must start at an address which is a multiple of 64 (e.g. we will use 13*64=8332 — the sprite is said to be in block 13 of memory, which is an area unused by other functions).

The sprites are controlled by a number of control registers, each being one byte of memory. In general, each sprite (eight are available at once) is controlled by one bit in each of these bytes e.g. bit 0 of all the registers corresponds to sprite 0, etc., and if this bit is 1, the function is "on", or if it is 0, the function is "off". Each control register will be explained as we go on.

## Starting the Program

The program has been kept as simple as possible so that you can see exactly how the sprites are controlled. It will be introduced in sections, so after reading the description, type in the next section of the program and RUN it. This will let you see what the new section of program does to affect the sprite's behaviour. Do **not** type NEW after each section.

REM statements have also been included in the program to detail its functions, but these may be omitted if you like to save typing, and the program will function normally. If the sprites are obstructing the screen when you want to type, then enter "POKE 53269,0" and press RETURN.

## Section 1 - Introduction (Lines 10-80)

Most of the sprite control registers are in a block of memory commencing at address 53248. To avoid using these large numbers, we will set a variable V to 53248 (line 40) and access the other registers by adding on numbers e.g. V+1, V+8, V+20 etc. Lines 50 and 60 set up two strings for printing messages during the program.

**Screen Colour Registers:** The registers which hold the screen colours are in this memory region at V+32(border) and V+33 (screen background). POKEing values from zero to 15 into these registers will change the colour of the screen. In this program, they are both set to colour six (blue) at line 80.

## Section 2 - Setting up the Sprites (Lines 99-140)

Lines 100 and 110 set the 63 bytes of sprite data to 255 to give a solid sprite, starting at memory address 832. Try experimenting with different values of BYTE (line 100) to see the effect on the shape of the sprites.

**Sprite Data Pointers:** The computer knows where you have put the sprite shape data by looking at the date pointers at locations 2040 (for sprite 0) to location 2047 (for sprite 7). The value to be POKEd to these registers is the data block number, in this case 832/64=13 (line 120).

**Sprite Position Registers:** Each sprite has an X (horizontal) and Y (Vertical) position co-ordinate, measured from an original at the top left of the screen (actually, this origin is underneath the screen border, the actual top left of the visible screen being at X=24, Y=50). These positions are stored in registers V+0 to V+15 as follows:

V+0 Sprite 0 X co-ordinate
V+1 Sprite O Y co-ordinate
V+2 Sprite 1 X co-ordinate
V+3 Sprite 1 Y co-ordinate

Line 130 sets the positions of the sprites (only sprites 0-3 will be used in this demonstration program) so that they will be diagonally across the screen.

**Sprite Enable Register:** Each sprite can be turned on and off (visible or not) by setting (on) or clearing (off) its corresponding bit in the sprite enable register at V+21. We are using sprites 0-3 so this register is set to 1+2+4+8=15 (line 140).

## Section 3 - Colouring the Sprites (Lines 149-180)

**Sprite Colour Registers:** Each sprite has a one byte register which contains its colour as a number from zero to 15, in the same way as the screen colour registers. These colour registers are at V+39 for sprite 0, V+40 for sprite 1, and so on up to V+46 for sprite 7. Here, the colours have been set so that the sprites are clearly visible on the background, (lines 150-180) but by changing the numbers after the comma, the sprites may be changed to any other colour you wish.

## Section 4 - Moving the Sprites [1] (Lines 200-210, 900-1180)

The sprite position registers have already been described. Making the sprites move is simply a case of changing the number held in these registers, so that the sprite changes position. Subroutine 1000 is called (line 200) to move the sprites across the screen (X-direction) and subroutine 1100 is called (line 210) to move them down the screen.

This paragraph describes subroutine 1000. Subroutine 1100 is similar in structure, but operates on different position registers.

Firstly, the sprite's current position is read in (line 1010) and stored in variable PSN. Two is then added to this position, and if PSN exceeds 255, it is reset to zero, as the maximum position number is 255. The new position is then POKEd to the position register (line 1050). This process continues until the sprite has returned to its starting position. The movement loop is executed for the four sprites.

## Section 5 - Moving the Sprites [2] (Lines 219-240)

X-Co-ordinate MSB register: You will have seen from the previous section that the maximum sprite position is 255, but this only gets the sprites about two-thirds of the way across the screen in the X-direction. In order to move the sprite to the right-hand third of the screen, the Most Significant Bit of the X-co-ordinate must be set. This register, containing one bit for each of the sprites is at V+16. By setting a bit in this register, the corresponding sprite appears in the right-hand part of the screen.

To demonstrate this, we move all sprites to the right part of the screen (line 220), call the movement subroutine again (line 230) and then move the sprites back (line 240). Note that for most of the movement section, the sprites are invisible under the right hand edge of the screen. In a program, the right-hand part of the screen would be accessed by a statement such as: XPOS=XPOS +1:IF XPOS=256 THEN XPOS =0:POKE V+16,SPRNUM with a corresponding statement for return to the main part of the screen.

## Section 6-sprite expansion (Lines 249-400, 1499-1520)

**Sprite Expansion Registers:** By setting the appropriate bits in these registers (V+23 for Y-expansion, V+29 for X-expansion), the corresponding sprites will appear twice as large in that direction. These can be used independently to give tall or wide sprites, or together to give a large sprite.

Subroutine 1500 automatically expands the next sprite in a given direction, then executes a delay, and returns to the main program. Firstly, we set the required expansion market to X (line 260), then call subroutine 1500 for the four sprites (lines 270-290). The X-expansion is then turned off (line 300), and the loop repeated for Y-expansion (lines 310-350). Repeating the X-expansion gives sprite expansion in both directions (lines 360-400).

## Section 7 - Sprite overlay (LInes 190, 429-550)

All the sprites on the screen have a display priority, that is they are each assigned a "depth" on the screen. Thus if two sprites are overlapped, either partly or entirely, the one which is "deepest" will not be seen as if it was behind the other sprite. This function allows three-dimensional effects to be constructed quite easily.

Unfortunately, however, the priority is not easily controllable. The "depth" of the sprite is controlled by its number: sprite 7 is the deepest, and so will appear behind all others, and sprite 0 will appear in front of all the others. The next section of program demonstrates this by overlapping all the sprites. You can see that the green sprite is at the back, and the black sprite is at the front (unless you've changed the colours!). Line 190 has been included so that you don't have to run through the movement demonstration everytime.

## Section 8 - Sprite/Text Overlay (Lines 599-730, 1999-2080)

**Sprite/Text Priority Register:** Although the sprites are fixed in relation to each other by number, each sprite can be individually set to be behind or in front of any text or graphics on the screen.

To demonstrate this, we will show the text layer by a grid covering the screen. This allows you to see sprites both in front of and behind the text. To control this position, we use the sprite/text priority register at V+27. Normally this register contains 0 making all sprites appear in front of the text. However, by setting the bits in this register, the corresponding sprites appear behind the text layer. This section is in three parts, with each part calling subroutine 2000 to move the sprites across the grid. This is done in a similar way to subroutine 1000 explained above.

The first part demonstrates all sprites in front of the grid. Next, the sprites (starting with the "deepest" one) are moved behind the grid, and you can see that it appears behind both the text, and the other sprites as before. Finally, the sprites are brought back in front of the grid as before, again starting with the "deepest". However, note the strange effect that this produces. As the sprites move across the grid, you can see that the deeper ones are in front of the grid, but still behind the other sprites which are behind the grid! This is a three-dimensional impossibility, unless you are Doctor Who, but visual logic apart, it

```
10 REM *** PLAYING WITH SPRITES    ***
20 REM *** BY IAIN MURRAY (C) 1985 ***
30 REM *** FOR YOUR COMMODORE      ***
40 V=53248:REM * START OF SPRITE MEMORY LOCATIONS
50 CL$=CHR$(147)+CHR$(142)+CHR$(5):REM * CLEAR SCREEN
60 HM$=CHR$(19)+CHR$(17):REM * HOME
70 PRINT CL$
80 POKE V+32,6:POKE V+33,6
99 REM ** SET UP SPRITE DATA BLOCK **
100 BYTE=255
110 FOR LOC=832 TO 832+62:POKE LOC,BYTE:NEXT LOC
119 REM ** SET UP DATA POINTERS **
120 FOR PTR=0 TO 3:POKE 2040+PTR,13:NEXT
129 REM ** SET SPRITE POSITIONS **
130 FOR PSN=0 TO 7:POKE V+PSN,(20*PSN)+60:NEXT PSN
139 REM ** TURN ON SPRITES **
140 POKE V+21,15
149 REM ** COLOUR SPRITES **
150 POKE V+39,0:REM * SPRITE 0 BLACK
160 POKE V+40,7:REM * SPRITE 1 YELLOW
170 POKE V+41,2:REM * SPRITE 2 RED
180 POKE V+42,5:REM * SPRITE 3 GREEN
190 GOTO 430:REM * ADD THIS LINE AFTER MOVEMENT DEMONSTRATI
ON
200 GOSUB 1000:REM * MOVE SPRITES IN X-DIRECTION
210 GOSUB 1100:REM * MOVE SPRITES IN Y-DIRECTION
219 REM ** MOVE SPRITES TO RIGHT OF SCREEN
220 POKE V+16,15
230 GOSUB 1000: REM * MOVE SPRITES AGAIN
240 POKE V+16,0:REM * MOVE SPRITES BACK ON SCREEN
249 REM ** SPRITE EXPANSION
250 PRINT CL$;"SPRITE EXPANSION IN X-DIRECTION"
260 XPND=29:REM * X-EXPANSION
270 FOR SPRITE=0 TO 3
280 GOSUB 1500
290 NEXT SPRITE
300 POKE V+29,0:REM * X-EXPAND OFF
310 XPND=23:REM * Y-EXPANSION
320 PRINT CL$;"SPRITE EXPANSION IN Y-DIRECTION"
330 FOR SPRITE=0 TO 3
340 GOSUB 1500
```

produces an interesting effect.

**Sprite Collision Detection Registers:** At the top of the screen during the text overlay section, a number appeared. This is one of the sprite collision registers. These are two registers which, unlike all the others we have discussed, cannot be POKEd to, but can only be read using the PEEK instruction. Each bit set in these registers indicates that the corresponding sprite is in collision with something.

The register at V+30 is a sprite-sprite collision sensor, while the register at V+31 is a sprite-text collision sensor. It is the value from V+30 which is displayed on the screen during the demonstration, and you can see how it changes as the sprites slide over each other. The sprite-text collision register works in a similar way, but displays overlaps between sprites and any text or graphics characters on the screen. As mentioned above, these registers cannot be set, but reading them makes sprite collision detection very simple.

Well, that is the end of the demonstration program. Although not all the functions of sprites have been given, these are the most important ones. To become more familiar with the handling of the sprite registers, try going back to some of the sections of the demonstration program and changing some of the numbers, and see if your change has the effect you expected.

From the experience you have gained from playing with this program, and by reference back to the listing, you should now be reasonably confident about using sprites and their versatile features in your own programs.

```
350 NEXT SPRITE
360 PRINT CL$;"SPRITE EXPANSION IN BOTH DIRECTIONS"
370 XPND=29:REM * X-EXPANSION AND Y-EXPANSION
380 FOR SPRITE=0 TO 3
390 GOSUB 1500
400 NEXT SPRITE
429 REM *** SPRITE OVERLAY DEMONSTRATION ***
430 PRINT CL$;"SPRITE OVERLAY DEMONSTRATION"
450 FOR SPRITE=0 TO 3
460 POKE V+(2*SPRITE),140
470 POKE V+(2*SPRITE)+1,140
480 NEXT SPRITE
490 FOR COUNT=1 TO 30
500 POKE V,PEEK(V)+1
510 POKE V+2,PEEK(V+2)+1
520 POKE V+3,PEEK(V+3)-1
530 POKE V+5,PEEK(V+5)-1
540 NEXT COUNT
550 FOR DELAY=0 TO 1000:NEXT DELAY
599 REM *** SPRITE/TEXT OVERLAY ***
600 PRINT CL$
610 FOR LINE=1 TO 24
620 PRINT "[s +][s +][s +][s +][s +][s +][s +][s +][s +][s
+][s +][s +][s +][s +
][s +][s +][s +][s +][s +][s +][s +][s +][s +][s +][s +][s
+][s +][s +][s +][s +
][s +][s +][s +][s +][s +][s +][s +][s +][s +][s +]":REM * 39 SH
IFTED "+"S
630 NEXT LINE
640 POKE V+27,0:REM * ALL SPRITES IN FRONT OF GRID
650 PRINT CHR$(19);"ALL SPRITES IN FRONT OF GRID
 "
660 OK=0:GOSUB 2000
670 PRINT CHR$(19);"ALL SPRITES BEHIND GRID
 "
680 OK=1:GOSUB 2000
690 PRINT CHR$(19);"SPRITES IN FRONT OF GRID, SOME BEHIND
 "
700 OK=0:GOSUB 2000
710 FOR DELAY=1 TO 1000:NEXT DELAY
720 PRINT CL$;"END OF DEMONSTRATION"
730 POKE V+23,0:POKE V+29,0
900 END:REM * STOP PROGRAM WITHOUT RUNNING INTO SUBROUTINES
999 REM ** MOVE SPRITES IN X DIRECTION **
1000 FOR SPRITE=0 TO 3:PRINT CL$;"MOVING SPRITE";SPRITE;"IN
 X-DIRECTION"
1010 BEGIN=PEEK(V+(2*SPRITE)):REM * START X CO-ORDINATE
1020 PSN=BEGIN
1030 PSN=PSN+2:REM * INCREMENT POSITION
1040 IF PSN>255 THEN PSN=0:REM * MAXIMUM PSN=255
1050 POKE V+(2*SPRITE),PSN:REM * MOVE SPRITE
1060 IF PSN<>BEGIN THEN 1030:REM * KEEP MOVING UNTIL BACK A
T START
1070 NEXT SPRITE
1080 RETURN:REM * GO BACK TO MAIN PROGRAM
1099 REM ** MOVE SPRITES IN Y DIRECTION **
1100 FOR SPRITE=0 TO 3:PRINT CL$;"MOVING SPRITE";SPRITE;"IN
 Y-DIRECTION"
1110 BEGIN=PEEK(V+(2*SPRITE)+1):REM * START Y CO-ORDINATE
1120 PSN=BEGIN
1130 PSN=PSN+2:REM * INCREMENT POSITION
1140 IF PSN>255 THEN PSN=0:REM * MAXIMUM PSN=255
1150 POKE V+(2*SPRITE)+1,PSN:REM * MOVE SPRITE
1160 IF PSN<>BEGIN THEN 1130:REM * KEEP MOVING UNTIL BACK A
T START
1170 NEXT SPRITE
1180 RETURN:REM * GO BACK TO MAIN PROGRAM
1499 REM *** SPRITE EXPANSION ***
1500 POKE(V+XPND),(PEEK(V+XPND) OR (2^SPRITE))
1510 FOR DELAY=1 TO 500:NEXT DELAY
1520 RETURN
1999 REM *** MOVE SPRITE ACROSS GRID ***
2000 FOR SPRITE=3 TO 0 STEP -1
2010 IF OK=0 THEN POKE V+27,(PEEK(V+27) AND (255-(2^SPRITE)
))
2020 IF OK=1 THEN POKE V+27,(PEEK(V+27) OR (2^SPRITE))
2030 BEGIN=PEEK(V+(2*SPRITE)):FOR PSN=0 TO BEGIN
2040 POKE V+(2*SPRITE),PSN
2050 PRINT HM$;PEEK(V+30)
2060 NEXT PSN
2070 NEXT SPRITE
2080 RETURN
```

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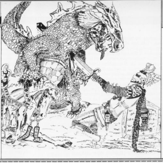

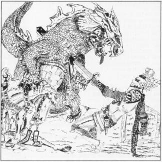

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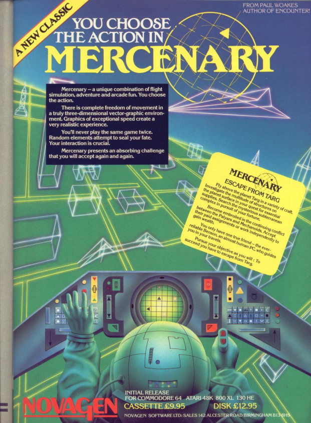

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# SPRITE IDEAS

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Now, Your Commodore comes to the rescue once again with Sprite Ideas. If you have designed any sprites for games and you don't mind other people seeing your masterworks then why not send them into us. Each month we will be offering £10 for the best entries.

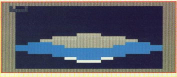
Your sprites can be anything at all (within reason), if you've designed a series of animated characters then send in the lot. We'd love to have a look at them.

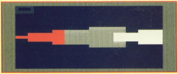
So, next time you are after an Ogre to put in your new game, have a look in this section of the magazine and you may find just what you are looking for.

**Saucer:**

```
DATA000,000,000,000,000,000,000,000
DATA000,000,000,000,000,000,000,000
DATA000,000,000,000,000,000,000,000
DATA000,000,000,000,020,000,001,085
DATA064,005,085,080,041,085,104,170
DATA085,170,170,170,170,042,170,168
DATA002,170,128,000,235,000,000,060
DATA000,000,000,000,000,000,000,000
```

**David Brun, Canterbury**





**Rocket:**

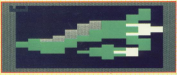
```
DATA000,000,000,000,000,000,000,000
DATA000,000,000,000,000,000,000,000
DATA000,000,000,000,000,000,005,064
DATA002,085,079,042,085,255,170,085
DATA255,042,085,255,002,085,079,000
DATA005,064,000,000,000,000,000,000
DATA000,000,000,000,000,000,000,000
DATA000,000,000,000,000,000,000,000
```

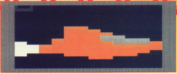
**Mike Roberts, Sittingbourne**

**Crane:**

```
DATA000,000,000,000,000,008,000,000
DATA008,000,000,040,000,000,040,000
DATA006,160,000,022,188,000,022,175
DATA000,090,175,000,090,188,001,106
DATA160,037,168,040,170,128,040,170
DATA130,008,042,010,184,010,042,240
DATA000,010,176,000,002,000,000,000
DATA000,000,000,000,000,000,000,000
```

**David Brun, Canterbury**

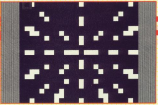




**Tucan:**

```
DATA000,000,000,000,000,000,000,000
DATA000,000,000,000,000,000,000,000
DATA000,000,000,000,000,000,160,000
DATA000,168,000,000,170,000,000,169
DATA064,002,169,084,194,170,086,250
DATA170,170,250,170,170,250,170,168
DATA192,170,160,000,010,000,000,000
DATA000,000,000,000,000,000,000,000
```

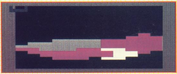
**Mike Roberts, Sittingbourne**



**Explosion:**

```
DATA032,008,002,000,000,000,008,000
DATA008,004,008,016,000,008,000,096
DATA000,003,048,128,134,004,073,016
DATA000,008,000,000,000,000,102,119
DATA051,000,000,000,000,008,000,004
DATA073,016,048,128,134,096,000,003
DATA000,073,000,004,008,016,008,128
DATA136,001,128,192,033,008,066,000
```

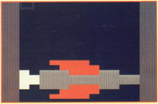
**Mike Roberts, Sittingbourne**



**Cruiser:**

```
DATA000,000,000,000,000,000,000,000
DATA000,000,000,000,000,000,000,000
DATA000,000,000,000,000,000,000,000
DATA000,000,000,000,000,008,000,000
DATA042,001,086,170,021,086,170,085
DATA086,170,165,107,234,042,170,248
DATA010,170,240,002,163,192,000,000
DATA000,000,000,000,000,000,000,000
```

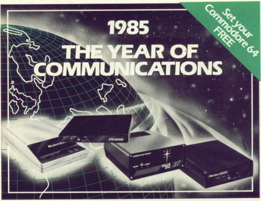
**David Brun, Canterbury**



**Chaser:**

```
DATA000,000,000,000,000,000,000,000
DATA000,000,000,000,000,000,000,000
DATA000,000,000,000,000,000,000,000
DATA000,000,000,000,000,000,000,000
DATA000,000,000,000,002,168,000,000
DATA170,000,197,106,080,245,085,085
DATA245,085,085,197,106,080,000,170
DATA000,002,168,000,000,000,000,000
```

**Mike Roberts, Sittingbourne**



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# PROGRAMMING PROJECTS

**This month's programming project shows how to draw contour maps for representing tables of numbers. By Garry Marshall.**

HAVE YOU EVER WONDERED how to write a program to draw a contour map? They crop up all over the place and, most recently, have been seen on the new, computerised BBC weather forecasts. A contour map is always a good way to represent a large table of numbers, whether they record meteorological data or anything else, in a way that is easy to understand.

The uses of contour maps include the maps showing the heights of the terrain as found in an atlas, and the stress contours generated by computer-aided design programs that can provide a guide to the structural integrity of a building or an aeroplane. This month's project is to write a program which, when given a table of numbers can draw the corresponding contour map.

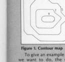

Figure 1. Contour map

To give an example of what we want to do, the contour map shown in Figure 1 was produced from the numbers in the following table.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 2 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 2 |
| 2 | 4 | 4 | 6 | 6 | 4 | 4 | 4 | 4 | 2 |
| 2 | 4 | 6 | 6 | 6 | 6 | 6 | 4 | 4 | 2 |
| 2 | 4 | 6 | 8 | 8 | 8 | 6 | 4 | 4 | 2 |
| 2 | 4 | 6 | 8 | 10 | 10 | 8 | 6 | 4 | 2 |
| 2 | 4 | 6 | 8 | 8 | 8 | 6 | 4 | 4 | 2 |
| 2 | 4 | 4 | 6 | 6 | 6 | 6 | 4 | 4 | 2 |
| 2 | 2 | 2 | 4 | 4 | 4 | 4 | 4 | 2 | 2 |
| 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |

When related to a weather map, this rectangular array of numbers corresponds to data collected from weather stations positioned neatly in a rectangular grid. This is the situation which our program will deal with. Naturally, weather stations are not positioned regularly in practice, and have to be placed wherever it is suitable and convenient. The program we shall develop in this project can be generalised readily so it draws a map for a set of numbers each of which has a position associated with it.

## The solution

The program will start by reading a square array of even numbers. Then it will draw the contours for the odd numbers lying in between these even numbers in such a way as to fill the screen.

The even numbers are restricted so that, for every number, the number next to it must be the same as it or the next even number above or below it. By restricting the numbers in this way, we can get on with drawing the contours as quickly as possible. If we allow the table to contain any type of number, then we must spend a great deal of time computing such things as the range of the numbers and the values for the contours. This only obscures the point of the project, which is to draw contours. Once you have seen how the program does this it is not at all difficult to start to draw contour maps for less restricted tables of data.

Restricting the numbers so that a neighbouring number can only be one of three possibilities corresponds to dealing with situations in which the data is 'smooth', and this is how it is in the majority of situations encountered in practice. Most terrains are smooth, with cliffs occuring quite rarely, and meteorological data is mostly smooth, with only something like a hurricane providing the exception.

We can illustrate the way in which our program finds contours with the aid of Figure 2. We start with a table of numbers, such as:

| | | |
|---|---|---|
| 4 | 6 | 8 |
| 6 | 6 | 6 |
| 8 | 8 | 8 |

We then find a value for each point marked in Figure 2a that is mid-way between the numbers in each row and column. The table in Figure 2b is obtained by working out these values by taking the average of the numbers on either side of it. The contours can then be drawn, as in Figure 2c, by joining any of these points that has an odd number to an adjacent point with the same number.

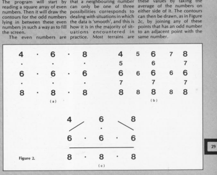

Figure 2.

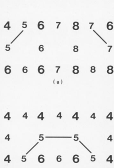

Figure 3.

The joining lines can be horizontal, vertical or diagonal. A little experimentation will show that there are only a few ways in which these lines can be drawn. From the mid-points in the top row, row 1, or in any odd numbered row, the lines can be drawn diagonally or vertically as shown in Figure 3a. From the points in even numbered rows, the lines can be drawn diagonally or horizontally, as shown in Figure 3b.

This is exactly how the program for drawing contours will work. It reads a table of numbers, computes the values at the mid-points between the data points, and then joins up any adjacent points that contain the same odd number. In this way, the program gives the contours for all the odd numbers lying between the highest and the lowest (even) numbers in the original table.

## The program

To make the program deal with a table of numbers of any size, it begins by reading a value for N, the number of rows and columns in the table. Then it dimensions the array, A, into which the table is to be read, and the array B, which is to hold the numbers of the original array and the numbers between them, as shown in Figure 2b. This gives:

```
10 INPUT N
20 DIM A(N, N), B(2*N, 2*N)
```

Strictly speaking, if A has N rows and columns, then B will have N + (N-1), that is 2*N-1. But by dimensioning B so that it has 2*N rows and columns, we can place zeros in row and column N, and in row and column 0 as well, to create a surround for the important part of the array, and so avoid some nasty edge effects in subsequent calculations.

Next, the table can be read into A, its entries copied into the appropriate elements of B, and the surround for B created with:

```
30 FOR Y=1 TO N: FOR X=1 TO
N
40 READ A(Y, X)
50 B(2*Y-1, 2*X-1)=A(Y, X)
60 NEXT X: NEXT Y
70 FOR X=0 TO 2*N
80 B(0, X)=0: B(2*N, X)=0
90 NEXT X
100 FOR Y=0 TO 2*N
110 B(Y, 0)°=0: B(Y, 2*N)=0
120 NEXT Y
```

Here, as elsewhere in the program, Y is used to number the rows in the arrays and X the columns. The values at the points mid-way between the original data points can now be computed, first along the rows and then down the columns, and placed in B by:

```
130 FOR Y=1 TO 2*N-1 STEP 2
140 FOR X=2 TO 2*N-2 STEP 2
150 B(Y, X)=0.5*(B(Y, X-!) +B(Y,
X+1))
160 NEXT X: NEXT Y
170 FOR X=1 TO 2*N-1 STEP 2
180 FOR Y=2 TO 2*N-2 STEP 2
190 B(Y, X)=0.5*(B(Y-1, X) +
B(Y+1, X))
200 NEXT Y: NEXT Y
```

With the data entered and the preliminary computations complete, we can prepare the high-resolution graphics screen by calling our usual routine with:

```
210 GOSUB 500
```

When the contours are plotted, we could use the row and column numbers of the elements of B as screen co-ordinates. But, to ensure that the contour map fills the screen and is as large as possible, we shall scale these numbers up by multiplying the column numbers by 320/(2*N) and the row numbers by 200/(2*N). These factors are calculated by:

```
220 XS=INT(160/N): YS=INT
(100/N)
```

Now we are ready to plot the contours, and the lines starting from any points in the odd numbered rows of B can be dealt with by ignoring all but the values that are odd and, for them, testing to see if one of the diagonal lines or a vertical line needs to be drawn. When a line is to be drawn, it is only left to place the necessary values in X1, X2, Y1 and Y2 and to call the line-drawing subroutine starting at line 2000, which draws a line from (X1, Y1) to (X2, Y2). This can be done by:

```
230 FOR Y=1 TO 2*N-3 STEP 2
240 FOR X=2 TO 2,N-2 STEP 2
250 IF B(Y, X)=2*INT(B(Y, X)/2)
THEN 290
260 IF B(Y, X)=B(Y+1, X-1) THEN
Z1X*XS: Y1=Y*YS:
        X2=(X-1)*XS:  Y2=(Y+1)*
YS: GOSUB 2000
270 IF B(Y, X)=B(Y+1m X+1)
THEN X1=X*XS: Y1=YS:
        X2=(X+1)*XS:  Y2=(Y+1)*
YS GOSUB 2000
280 IF B(Y, X)=B(Y+2, X) THEN
X1=X*XS: Y1↑Y*YS:
        X2=X*XS:  Y2=(Y+2)*YS:
GOSUB 2000
290 NEXT X: NEXT Y
```

In similar vein, the even numbered rows of B can be dealt with by:

```
300 FOR Y=2 TO 2*N-2 STEP 2
310 FOR X=1 TO 2*N-1 STEP 2
320 IF B(Y, X)=2*INT(B(Y, X)/2)
THEN 370
330 IF B(Y, X)=B(Y+1, X-1) THEN
X1=X*XS: Y1=Y*YS:
X2=(X-1)*XS: Y2=(Y+1)*YS:
GOSUB 2000
340 IF B(Y, X)=B(Y+1, X+1) THEN
X1=X*XS: Y1=Y*YS:
X2=(X+1)*XS: Y2=(Y+1(*YS:
GOSUB 2000
350 IF X=2*N-1 THEN 370
360 IF B(Y, X)=B(Y, X+2) THEN
X1=X*XS: Y1=Y*YS:
X2=(X+2)*XS: Y2=Y*YS: GOSUB
2000
360 NEXT X: NEXT Y
```

Line 350 must be included to avoid exceeding the array limits for B. If we had not given B its surround of zeros, we should have had far more worries of this kind.

The complete program, with data and subroutines, is listed as Figure 4.

## Further developments

As already suggested, there are a number of developments that can extend the program. To begin with, they will centre on ways of reducing the restrictions on the data initially accepted by the program. At present, the data must be smooth enough that not more than one contour passes between any pair of the initial points. If the data is less smooth than this then the array B must be made correspondingly larger so that it can hold more points in between the initial points to allow more contours to pass between them.

The way in which our program draws contours is sufficiently robust to be used with tabulated numbers of any kind and, indeed, any numbers each with their own associated position.

Finally, a way of labelling the contours would improve any contour map.

### Program Listing

```
10 READ N
20 DIM A(N,N), B(2*N, 2*N)
30 FOR Y=1 TO N: FOR X=1 TO N
40 READ A(Y, X)
50 B(2*Y-1, 2*X-1)=A(Y, X)
60 NEXT X: NEXT Y
70 FOR X=0 TO 2*N
80 B(0, X)=0: B(2*N, X)=0
90 NEXT X
100 FOR Y=0 TO 2*N
110 B(Y, 0)=0: B(Y, 2*N)=0
120 NEXT Y
130 FOR Y=1 TO 2*N-1 STEP 2
140 FOR X=2 TO 2*N-2 STEP 2
150 B(Y, X)=0.5*(B(Y, X-1)+B(Y, X+
1))
160 NEXT X: NEXT Y
170 FOR X=1 TO 2*N-1 STEP 2
180 FOR Y=2 TO 2*N-2 STEP 2
190 B(Y, X)=0.5*(B(Y-1, X)+B(Y+1,
X))
200 NEXT Y: NEXT X
210 GOSUB 500
220 XS=INT(160/N): YS=INT(100/N)
230 FOR Y=1 TO 2*N-3 STEP 2
240 FOR X=2 TO 2*N-2 STEP 2
250 IF B(Y, X)=2*INT(B(Y, X)/2) TH
EN 290
260 IF B(Y,X)=B(Y+1,X-1) THENX1=X*
XS:Y1=Y*YS:X2=(X-1)*XS:Y2=(Y+1)*YS
:GOSUB 2000
270 IF B(Y,X)=B(Y+1,X+1) THENX1=X*
XS:Y1=Y*YS:X2=(X+1)*XS:Y2=(Y+1)*YS
:GOSUB 2000
280 IF B(Y,X)=B(Y+2,X) THENX1=X*XS
:Y1=Y*YS:X2=X*XS:Y2=(Y+2)*YS:GOSUB
 2000
290 NEXT X: NEXT Y
300 FOR Y=2 TO 2*N-2 STEP 2
310 FOR X=1 TO 2*N-1 STEP 2
320 IF B(Y, X)=2*INT(B(Y, X)/2) TH
EN 370
330 IF B(Y,X)=B(Y+1,X-1) THENX1=X*
XS:Y1=Y*YS:X2=(X-1)*XS:Y2=(Y+1)*YS
:GOSUB 2000
340 IF B(Y,X)=B(Y+1,X+1) THENX1=X*
XS:Y1=Y*YS:X2=(X+1)*XS:Y2=(Y+1)*YS
:GOSUB 2000
350 IF X=2*N-1 THEN 370
360 IF B(Y,X)=B(Y,X+2) THENX1=X*XS
:Y1=Y*YS:X2=(X+2)*XS:Y2=Y*YS:GOSUB
 2000
370 NEXT X: NEXT Y
380 DATA 10
390 DATA 2,2,2,2,2,2,2,2,2,2
400 DATA 2,4,4,4,4,4,4,4,4,2
410 DATA 2,4,4,6,6,4,4,4,4,2
420 DATA 2,4,6,6,6,6,6,4,4,2
430 DATA 2,4,6,8,8,8,6,4,4,2
440 DATA 2,4,6,8,10,10,8,6,4,2
450 DATA 2,4,6,8,8,8,6,4,4,2
460 DATA 2,4,4,6,6,6,6,4,4,2
470 DATA 2,2,2,4,4,4,4,4,2,2
480 DATA 2,2,2,2,2,2,2,2,2,2
490 END
500 POKE 53272, PEEK(53272) OR 8
510 POKE 53265, PEEK(53265) OR 32
520 FOR I=8192 TO 16192: POKE I, 0
: NEXT I
530 FOR I=1024 TO 2023: POKE I, 22
: NEXT I
540 RETURN
1000 RO=INT(R/8): CO=INT(C/8)
1010 L=R AND 7
1020 BIT=7 - (C AND 7)
1030 BYTE=8192 + RO*320 + CO*8 + L
1040 POKE BYTE, PEEK(BYTE) OR 2^BI
T
1050 RETURN
2000 DX=X2-X1: DY=Y2-Y1
2010 IF DX=0 THEN 2070
2020 FOR C=X1 TO X2 STEP SGN(DX)
2030 R=INT(Y1+(C-X1)*DY/DX)
2040 GOSUB 1000: REM PLOT POINT
2050 NEXT C
2060 RETURN
2070 C=X1
2080 FOR R=Y1 TO Y2 STEP SGN(DY)
2090 GOSUB 1000: REM PLOT POINT
2100 NEXT R
2110 RETURN
```

Figure 4. Complete program listing.

# Scratchpad

**More bits and pieces to make you and your computer work better together.**

THIS MONTH'S SELECTION of short routines starts off with a very handy routine from 1. Wraith of Sheffield.

The Commodore 1520 plotter printer is a very useful little device, especially when you realise how much cheaper it is than a standard printer. Unfortunately the 1520 has a device number of six while other printers for the C64 have a device number of four. This makes the 1520 incompatible with most C64 programs that output to the printer. I. Wraith's short machine code program makes the 1520 compatible with most programs.

The program works by changing the Kernal Open Vector and altering the device number which is to be used. Once you have RUN the program you will be able to access the 1520 as device number four. Your 1520 will now work with a number of programs for the first time.

Judging by the number of telephone calls we get in the office about the subject, it would appear that a lot of readers want to know how they can make characters flash on the screen as on the Spectrum or BBC. Unfortunately there is no easy way to perform this function on a C64 but this neat utility from Steve Mehew not only gives you the ability to flash characters but will also let you centre a line of text on the screen.

The flash routine allows you to have any text you wish flashing between one colour and another. It is started by the following command:

SYS 52736,A,B,C

where A and B are the two colours, and C is the speed. A speed of 50 would cause one colour to be held on for one second, 100 for two seconds and so on. To stop the flashing either make A and B the same and call the routine again or use:

SYS 52887

The second routine will print a line of text neatly in the centre of the present line. It is used as follows:

SYS 52868,a$

where A$ is the string to be printed. It can contain any of the 256 characters, but cursor characters will upset the centering.

Well that's it for this month. If you have any handy little routines that may be of use to other people or any hints which may help other users with their programming then why not send them into Scratchpad, Your Commodore, No 1 Golden Square, London W1R 3AB.

```
10 REM ***** PLOTTER CHANGE *****
30 DATA169,11,141,26,3,169,192,141,27,3,96,8,72,165
40 DATA186,201,4,208,4,169,6,133,186,104,40,76,74,243
50 FORA=49152TO49179:READW:POKEA,W:X=X+W:NEXT
60 IFX<>2857THENPRINT"CHECKSUM ERROR":END
70 SYS49152
```

```
100 REM  'FLASH' AND 'CENTRE' ROUTINE.
110 REM  ------------------------------
120 REM
130 REM COPYRIGHT STEVE MEHEW, MAY 1985
140 REM -------------------------------
150 REM
160 S=52736:CS=0:AD=CS
170 FOR L=0 TO 20:LC=0
180 FOR D=0 TO 8:READ B:POKE S+AD,B
190 AD=AD+1:CS=CS+B:LC=LC+B
200 NEXT:READ B:CS=CS+B
210 IF LC<>B THEN 300
220 NEXT:IF CS<>48078 THEN 400
230 PRINT:PRINT"ALL DATA IS CORRECT.":END
300 PRINT:PRINT"DATA ERROR IN LINE ";L*5+500
310 STOP
400 PRINT:PRINT"SERIOUS DATA ERROR.  TWO OR"
410 PRINT"MORE ERRORS IN DATA AND LINE"
420 PRINT"CHECKSUM.":STOP
500 DATA 76,86,206,120,169,16,141,20,3,837
505 DATA 169,206,141,21,3,88,96,198,253,1175
510 DATA 240,3,76,49,234,169,127,141,13,1052
515 DATA 220,165,2,133,253,169,4,133,187,1266
520 DATA 169,0,133,251,169,216,133,252,160,1483
525 DATA 0,177,251,41,15,197,254,208,7,1150
530 DATA 165,158,145,251,76,69,206,197,158,1425
535 DATA 208,4,165,254,145,251,200,208,230,1665
540 DATA 230,252,198,187,208,222,169,255,141,1862
545 DATA 13,220,76,49,234,32,253,174,32,1083
550 DATA 158,183,134,254,32,253,174,32,158,1378
555 DATA 183,134,158,32,253,174,32,158,183,1307
560 DATA 134,2,76,3,206,40,67,41,83,652
565 DATA 46,77,69,72,69,87,45,77,65,607
570 DATA 89,32,49,57,56,53,32,253,174,795
575 DATA 32,158,173,32,166,182,201,40,176,1160
580 DATA 20,74,133,159,169,20,56,229,159,1019
585 DATA 170,169,32,32,210,255,202,208,250,1528
590 DATA 76,33,171,162,23,108,0,3,120,696
595 DATA 169,49,141,20,3,169,234,141,21,947
600 DATA 3,88,96,255,0,255,0,255,0,952
```

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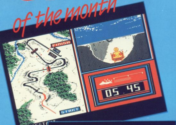
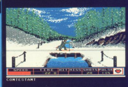
**Peter Thomas has risked frostbite and mortal injury to bring you this review.**

# GAME of the month





HOLD ONTO YOUR JOYSTICKS FOR A thrilling contest amid the snow and ice, in the follow up to Summer Games I and II, with Winter Games.

All the old familiar graphics remain, the white doves flying across the screen as the torch glows brightly in the foreground, only this time the background is realistically covered in snow.

Prior to commencing battle against the wintery conditions you first choose the country you wish to represent, then decide the number of participants, between one and eight, and go for gold.

The wise athlete will practice before commencing in competition against other human opponents. Spend time preparing for an assault on the World record.

The excitement begins with the Hot Dog Ariels. You start perched high up on a ski slope clad in your protective clothing, which is a must to prevent bodily damage, and a pair of skies. The aim is to dazzle the judges with your artistry as you flip through the air attempting such manoeuvres as a 'Daffy', 'Back Scratch' or 'Mule Kick'; to name just three. Or, if you really want to score high try combining a 'Stunt' and 'flip' in mid-air. The main problem is that you have to land on your feet. Tearing the skin off your bottom only rates as a third degree burn.

If you survive the Hot Dog Ariels without getting too much mustard on your face and without breaking a leg you move onto the Biathlon. Armed with a .22 calibre rifle you ski uphill and downhill until you are confronted with the targets. Quickly, you arm your gun, pull the trigger and fire – bullseye! But, beware because although speed is of the essence, if your heart beats too fast it will affect your accuracy. So, keep an eye on your pulse rate and don't get too overheated.

Something everyone will enjoy is the compulsory one-minute figure skating. You have 60 seconds to complete seven movements as you gracefully whirl around the ice rink. Skate forwards and backwards attempting such delights as double axel jumps and sit spins. Falling or moving awkwardly will not impress the judges; can you emulate Torvil and Dean and score a row of perfect sixes?

The music changes dramatically as you crouch low at the top of the ski jump. Speed, timing and joystick control are of the essence in this very exciting event. Then, you gather speed in a crouched position travelling down the slope, prepare for take-off and soar through the mountain air. While in mid-flight you hastily re-adjust your position to gain maximum distance and reduce wind resistance. Practicing this event while you strain every muscle to achieve an extra meter will while away many a happy winter evening.

After the exhiliration of the ski slope comes the 30mph speed skating. Race against the clock with either computer or human opposition. This has a similar setting to the cycling in Summer Games II so the split level screen allows you to view how far your foe is lagging behind as he tries to compensate rhythm for brute strength.

Calm your pulse rate and get your blood pressure down by re-entering the ice rink for two minutes of free skating. If you over spin your skater will become dizzy and unceremoniously fall on the ice – painful!

The last event you start on your bottom instead of finishing on it as in most of the other events. Sit back, shut your eyes, say a very quick prayer and off you career down a very fast bobsleigh track. I advise valium before you attempt the hair-raising turns before entering the final straight at 90mph. Go too fast and you land up in hospital. One last bit of advice don't drink and drive, it is dangerous for your health.

Again US Gold has come up with a winner. I eagerly await a Winter Games II in the hope it will contain a downhill slalom, by then I might have regained my balance.

**P.M.**

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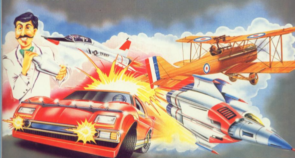

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**Not content with studying other people's adventures, Runecaster has now been creating his own. Read on to find out how.**

# SENSE OF ADVENTURE

## Do-It-Yourself...Almost

WE HAVE SEEN PROGRAMS TO ENABLE the non-programmer to write text adventures, some of which even allow reasonable graphics to be added. We have also had a selection of games creators that can be used to put together fairly rudimentary arcade games.

Now, into this games creator arena for the C64, sweeps Ariolasoft, with a very comprehensive package for the graphics adventure buff. Only available on disc, the *Adventure Construction Set* at £14.95, gives the user a veritable host of ready-made characters, objects and facilities from which to build a dream adventure!

Not only can you create the whole adventure yourself but, if you get bogged down, lazy or just inquisitive, then you can hand over the completion of the game to the *Adventure Construction Set* — just sit back and let it take over where you left off and it will create a working adventure from your bare bones! Mind you this can take anything up to 40 minutes.

Adventure Construction Set™
ariola

Although large numbers of characters, objects etc. have already been created and are at your beck and call, all of them may be altered to your specifications, either graphically or their attributes (strength, weight, associated text etc.) changed.

The basic format for any of these adventures consists of a 'world map' that your players explore (up to four characters may be chosen — each taking turns to move). Within this area there will be access points (doors, castles etc.) to further regions where the majority of the action will take place.

The world map is 40 × 40 squares, of which a 10 × 15 area is visible — the map scrolls as your players move across it. There may also be isolated 'events areas' in addition to the main regions.

## Two to Start With

Two adventures are included on the disc, one, *The Land of Aventuria*, contains a tutorial adventure plus six other mini-adventures to help the newcomer 'get the feel' of what is possible. The second, *Rivers of Light*, is a complex adventure set in ancient Egypt, that should keep even the hardened adventurer busy!

When you start using the *Adventure Construction Set*, you will have to create a working 'adventure disc'. This involves quite a lot of disc swapping (the ACS disc and your 'adventure disc'), so do not expect to be playing an adventure in just minutes — allow yourself time.

Before creating this work disc, you must decide what options you want on the disc. You will need a separate work disc for each adventure — either one you are about to construct or one of the two already on the ACS disc. It is probably wise to start with *The land of Aventuria.*

Playing and creating adventures is mainly carried out by using a joystick (or joy-pad/card) and all the on-screen operating instructions are clear and well explained. The program is well thought out and appears to be almost foolproof...even at this stage this is apparent, if you have inserted an unformatted disc (for your working disc), it checks, and formats it if necessary!

Once you have a working disc with *The land of Aventuria* on it, you can play the game, learning as you go. Or you can practise editing what is already there.

Playing the adventures will initially present you with the choice of creating or adding a new player. Again one is quite impressed with the vast number of options you are given for the graphical representation of your character.

Admittedly these are in fact all the characters/objects that may appear within the framework of the game but even so, given a hundred odd icons to choose from does tend to leave one a little stunned!

## On the Track

Having chosen and named your character(s), the screen displays part of the world map, complete with trees, mountains, seas, castles, deserts etc. Bars of colour on either side of the screen display how much time for movement your player has left on this turn and also his/her current 'power' and 'life force'.

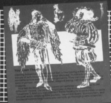
Four lines beneath the map are used for text messages, instructions and further menus. You may now either move, using the joystick, or 'select other options' by pressing the 'fire button'.

Other options, displays 12 possibilities, including: use object, drop object, use power (spells), ready new weapons or armour, quit, save, fire (missile weapon) and profile. Most of these have fairly obvious uses, the last — profile — gives you a complete inventory of your character. Not only will it tell you what is being carried but also a full breakdown of their constitution, wisdom, strength, dexterity, missile skill, melee skill, life force, parry skill etc! All of which may assist in helping you decide what course of action to take next.

There are plenty of creatures wandering around but you must try and identify which are worth attacking. If you have a suitable weapon you may attack from a distance, although how well you aim, is dependent upon your character's prowess with missile weapons (check your profile).

Just as each player has a certain time each turn to move or take any other action so too do all the creatures you meet! You may choose to ignore them but they may be more aggressive and choose not to ignore you! If battle is joined, then the results of each blow are shown in the text window below the display.

Objects initially seen as you enter a location may not be all that is there, often further items are hidden underneath! As in most adventure games there is plenty of treasure around but carry too much and movement may become difficult.



## Watch Out

As you move around one of two things may happen: First, you can 'fall upon' one of the 'map creatures', these may be friendly and have something to give you, so be wary of launching an unprovoked attack! Should you do this they may then understandably change from friend to foe.

Secondly, you may enter a 'square' (castle, portal, door etc), that will transport you somewhere else, or to one of the many regions within the game. These regions consist of a number of interlinked 'rooms', where you will find all the major puzzles that you have to solve, to win through to the end.

There are weapons, artefacts and spells to be found — all graphically portrayed — just move your character as though you want to stand on top of them and they are yours. Some you'll wish you never found!

With each complete adventure there is a final goal i.e. some object/character that has to be found and taken, rescued etc. Needless to say, this goal should not be one that can be achieved without completing other parts of the quest. Indeed, there are conditions that can be set on whether doors or portals will or will not operate, dependent upon items carried.

## Roll Your Own

The instruction booklet (40-odd closely printed pages), draws the comparison between this program and making a movie. There are many similarities, you have to choose your cast, your locations and all sorts of interesting props.

Although the presentation of menus and instructions 'on-screen' are usually clear and explicit, read the written instructions first! At the first read they may seem too much to grasp but as you become more familiar with the program, they will all make sense!

Also, even if you don't understand a particular action very clearly, at least the vague memory of a certain possibility may well trigger off something useful later!

The initial stages require you to create a new working disc (or you could practise by editing the game already on your adventure disc above). For your own adventure you will probably wish to start from scratch. Here is your first of many hundreds of decisions.

There are three types of adventure construction sets available: Fantasy, Science Fiction or Spy/Mystery. The basic concepts of all three are similar with world maps, regions, portals etc. but the sets of ready made characters, objects and terrain possibilities, are tailored to suit the subject.

Having chosen the set you want just follow the on-screen instructions — you now have the basic tools of the trade. Although there are plenty of 'things' with which to create the map and the creatures and the objects to be found and used, there is no substitute for plenty of forward planning!

You must have more than a rough idea of what you want your adventure to achieve.

First, the world map — think carefully of what you want to represent. What areas should characters be able to travel across freely? What obstacles do you wish to put in their path and, having put them there, what is their purpose? Does the placing of your special regions make any sort of sense?

Secondly, the regions — presumably at least some of these will need to be visited in the correct order (items found in one required to find items in another etc.). Think carefully about the overall concept of your game before you start creating regions willy-nilly!

Thirdly, consider the objects and creatures that are going to be found — both in the vital regions and also as one-off encounters whilst wandering around the world map. Does their placement make some sort of sense? If

Anyone using this package can create a working adventure – it's almost fool-proof – but only with careful planning and attention to detail, can you produce a game with that added something that others are really keen to play and solve.

## Do Your Own Thing

You may think that because all users are given the same terrain, objects and creatures, all ACS adventures would have a certain similarity. . .not so! Not only may you alter the graphical representation of all the current graphics, you can also create new creatures and objects (up to a maximum of 128 in each case).

Each creature, object and terrain option has certain conditions and attributes (a creature has the most options: 20 different basic attributes — not counting variations on each of these or which of umpteen objects they may possess!). These attributes may be modified to suit your adventure.

Having altered the name, shape, and attributes for a creature in the master list, you may then alter them again when you place him/her/it actually in the location of your choice! So although, you may have a general basic giant, specific giants may be stronger, faster or better armed than others elsewhere!

Each of these attributes is explained fully in the instruction booklet, so really what appears in your adventure is solely limited by your imagination. You can even have a creature attack until the player hits it — it then turns tail and keeps out of the way!

If fixed events are not enough then facilities exist to have random creatures appearing you choose the creature and the percentage of time that you wish it to be present.

There are of course a range of spells available. You may well ask how these are applicable to Spy/Mystery or Science Fiction adventures. Spells basically affect either the players or their surroundings, so a spell of 'decreasing life force' from the fantasy world could be likened to a poisoned drink in a dubious bar in Marseilles.

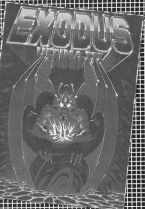
There are similar parallels to be drawn in other contexts. Think about it, there are some interesting philosophical questions raised by this line of thought.

'Doorways' between locations can come in a variety of forms, from simple two way passages open to all to locked doors to portals only accesible to those with certain objects in their possession.

## Finally

Throughout your use of this program you will probably be changing discs at fairly regular intervals — do not be tempted to be lazy, remember to put the disc that is not in the drive, back in its sleeve! The law of cussedness is bound to come into effect and damage the exposed disc. . .you have been warned!

There is just not enough space here to list all the variations possible with Ariolasoft's *Adventure Construction Kit*. The only real snag for those to whom it appeals is likely to be: will their computers have worn out before they have explored all the possible 'alternative realities' available from ACS?



## Exodus Update

Those of you who read and believed my rave about US Gold's *Exodus: Ultima III*, will have sought out a copy for yourselves. You will either feel I over-reacted or will be hooked, and deep in the wilds of Sosaria. . .

First, for those of you that did not get copies of the booklets explaining the Wizard's Spells or the Cleric's Spells — all is not lost. Just send a stamped addressed envelope (9 ×6 inches or bigger) to US Gold, Unit 10, The Parkway Industrial Centre, Heneage Street, Birmingham B7 4LY. State where you bought your software and the missing books will be sent to you.

Secondly, how are you progressing? Have you realised that if you visit Lord British in his castle after a character has increased in 'Level', that your maximum hit points increase? Have you found a boat and sailed the seven seas? No? Then try attacking one of those pirate ships! But time your attack to coincide between cannon-fire and always approach the pirates along a vertical or horizontal line — rapidly.

Talk to those you meet, especially in far-off places — and write down what they say. Powders enable a party to 'negate time' — exceedingly useful if there are dragons about! Has anybody found the town of Dawn?

What form of 'party' do you find best? Do you change the members of the team for special missions? Are you able to heal your companions regularly with SANCTU (Cleric Spell 'C')? Long may the spell of wonder and exploration last.

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Please allow 21 days for delivery YC1 **digi ever hear such a sound?**

# BUSINESS FILE

**Dave Crisp looks at a wordprocessing package and gives a run down of printers and interfaces.**

## A Wordprocessor Package

WORD PROCESSING AGAIN? WELL, IT may seem so but apart from games this is what you will find most computers doing most often.

After trying many printers, countless interfaces and almost every wordprocessor, I think I am now in possession of the most versatile package available at this time.

I am not going to go over the pros and cons of wordprocessor software, because I want to have a look at the new wordpro from Precision first in case it's even better than the Vizawrite which at the moment is the best I have seen. That will be in a later issue. Instead I will, very briefly, mention the Wordpro software and then go onto the other end of wordprocessing, the printer.

There are basically two types of wordpro. Pre-formatted and post-formatted. The post-formatted type works on the principle that format characters typed into the document take effect only when the document is printed or when the document is viewed. This means that you cannot see the document as it will be printed without leaving the text editor. Pre-formatted wordprocessors allow you to 'see' the effect that the formatting symbols will have as you type.

Easyscript is an example of a post-formatted type, and Vizawrite is of the pre-formatted variety.

Personally I prefer the pre-formatted software though it seems that opinion between users is split 50/50.

The problem with the C64 is that it can only display 40 characters of text at a time. This means that if your page is set anywhere over 40 characters you have to scroll over the page in order to see exactly what it looks like. A disadvantage but one that I have learned to live with.

There are many functions involved with text editing and so it is important to choose one which has logical commands as nothing slows down typing more effectively than constant referral to a manual to find out how to insert a tab and so on. For this reason I go for Vizawrite.

## Hardcopy

Going onto printers and printing you come across the problem of printer compatability. The Commodore range of printers is not too bad, indeed over the last 12 months Commodore has brought out some nice machines. However it seems that a lot of people want a printer from the Epson stable or one similar. This is a good choice though the first problem is that it is not compatible.

There is now a massive range of interfaces available in order to run centronics printers from the Commodore. They start at about £15 and go on up to around £200.

Before you rush out and buy one, stop and see what your needs will be. If you only seem to use a printer for listing programs and simple jobs then a simple lead and driver software may be all you need. This should cost between £15 and £20. It is simple, cheap and does the job. If you use the more popular commercial software you may find that software is built in which will drive the printer with just the lead so think – before you spend – before you print.

If you are in a position where you use a lot of varied software and are never quite sure what you may need, it may be worth splashing out and getting a more versatile interface. These do not come cheap but can save hours of frustration when trying to re-locate machine code driver software in order to avoid conflict with an expensive piece of new software.

The best of these 'HARD' interfaces plug into the serial port of your Commodore. This means that you can keep your user port free and use your printer in exactly the same way as a Commodore printer.

Some months ago I wrote about the GT Turbopoint interface. I raved about it and said it was the best thing since wholemeal bread. It was brilliant, it still is but I now use something even better. It is the Micro Control Systems Interface. It consists of a circuit board and five pin to five-pin lead.

This board fits inside the printer and on some versions allows twin din-sockets to fit in the printer case so you can daisy chain your peripherals as though it was a Commodore printer. Excellent. Versions are available for Epsons, Kaga, Canon and more.

There is a small built in buffer which frees your computer quite quickly with smaller documents and it can be switched either with jumpers or through software to allow you to choose different modes. These are full Commodore emulation, transparent, plus more depending on the version you have.

Commodore graphics are supported and for the first time I am now able to get good screen dumps from software such as Koala and doodle.

Fitting the board into the printer ranges from easy to fiddly depending on which printer you have so if in doubt ask someone who knows what they're doing as printers tend to be fussy about where you poke wild screwdrivers.

Because these boards offer you five-pin sockets it means there is a centronics port spare. For those of you with more than one machine it means that you can have both plugged into one printer. By the side of my printer I have a 64 and on the other there is a Sirius. If one is printing and you try to print from the other it will just wait. At first I thought I may get printed garbage but that is not the case.

Once the Micro Control Systems interface is in place you can forget about it. It does not get in the way, it does not require constant switching in order to make it work and it does not clog up your user port or require a 5V power supply from the cassette port.

This interface is the best thing since sliced wholemeal bread!

The choice of printer depends a lot on finance. Prices are dropping but you should still expect to pay £200 plus for a versatile and fast dot matrix printer. That is not to say that anything costing less is sub-standard. It may be just slower and have less facilities such as elite, proportional spacing, underlining, double strike, italics and near letter quality type etc, etc.

I am stuck on my Canon. It's fast, (160 cps) quiet, (compared to my Smith Corona daisywheel) and cheaper (than an Epson fx-80).

It will cope with friction fed-single sheet paper, fanfold and roll paper, without having to buy a roll holder as an extra. Its near letter quality is as good as anything I have seen on a matrix printer. It seems bulky but the space it takes up on the desk is about the same as most, it is just unusually high. Paper jams are rare and loading paper whether roll, sheet or fanfold is simplicity itself.

## In the End

If I were popping down to the local to buy a printer set up to go with a 64, I would not hesitate and I whole heartedly recommend the Micro Control Systems Printer Interface and in the printer dept the CANON PW-108A. Not cheap but very impressive.

# THE SECRET BEHIND THE NEW COMMODORE 64

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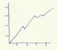
DO  ICS.

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EPSON

# RELIABLE R•O•U•

**Mike Hart brings you another article to make life easier — this month he deals with the Exclusive-or routine.**

## Exclusive—or Routine

THIS MONTH, I AM GOING to explore the workings of an Exclusive-or routine which is often used in cases where there is a need to 'encrypt' or to code the data in some form.

Obviously this is most useful when one wishes to protect data or programs and it should prove useful if you are already thinking along these lines. But first it is necessary to explain how an exclusive-or works and how it differs from an inclusive-or.

To understand both we need to look at the bit patterns of a couple of numbers to visualise the operations that are performed.

| | $2^7$ | $2^6$ | $2^5$ | $2^4$ | $2^3$ | $2^2$ | $2^1$ | $2^0$ | |
|---|---|---|---|---|---|---|---|---|---|
| | 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 | |
| **200 = $C8** | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | |
| **100 = $64** | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | |
| **200 incl.or 100** | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | = 236 ($EC) |
| **200 excl.or 100** | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | = 172 ($AC) |
| | | | | | | | | | |
| **100 = $64** | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | |
| **172 = $AC** | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | |
| **100 excl.or 172** | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | = 200 ($C8) |

The first two rows of the table are the decimal numbers 200 and 100 converted into their binary pattern. An inclusive-or is performed if there is a one in either of the two numbers and this is why 200 inclusive-or 100 gives the number 236. You may confirm this by typing in direct mode PRINT 200 OR 100 and this is the answer provided by the third row of the table. On the other hand, an exclusive-or will only return a bit pattern of one if either (but not both) of the bit patterns is a one and therefore row four gives 200 exclusive-or 100 as 172. This is actually quite complicated to demonstrate in Basic and is one of the few instances where machine-code is actually much easier than its high-level equivalent — all you need to code in machine code is LDA $C8 followed by EOR $64 to get $AC (= 172) In Basic you will need to type the following:

PRINT (200 OR 100) AND NOT (200 AND 100)

Having got our 'coded' number, what are we going to do with it? We could save the data in this encoded form. The really interesting thing is to observe what happens when we exclusive-or our 'new' number with the second of our original numbers. The second half of the table shows that performing an exclusive-or with the number we derived with the second number gives back the original number.

In order to encode a section of data, or even a whole program, all we need to do is encode the bytes that form our program with a sequence of numbers. The result is apparent gibberish but technically no information has been lost. If we can generate the sequence of numbers used to encode the program this can be used as a key to 'unlock' or 'decode' the encrypted code.

Some exclusive-or routines make use of the fact that the data in ROM is fixed in silicon, as it were, and therefore use the ROM data to provide a sequence of numbers to encode the original. However this is alright so long as you stick to your own machine but it is not unknown for Commodore to make small and unannounced changes to its ROMS and this might create difficulties for the future. The approach I have taken in the sample program is to make use of a simple algorithm which generates a sequence of numbers in the range 0-225. These are used for encoding.

In the sample program, you will see that line one is a SYS call followed by a REM, quote marks and then exactly 65 asterisks finished with a final quote. Type in this line with no spaces at all and it will just fit on to 80 spaces. To operate the program type 'RUN 2' and it will read the DATA statements for a machine code routine into the space provided by the asterisks. The rest of the program is of no consequence but merely a way of doing something.

When you list the program the machine code in the REM statement in line one will be converted to tokens and will look decidedly strange but do not worry. Now type (C64) SYS 2061. If you list the program it will not be encoded and will probably stop with a syntax error. Now RUN the program

# •T•I•N•E•S

### EXCLUSIVE-OR

```
1 SYS2061:REM"*****************************************
2 REM:DISABLE-POKE 809,188:POKE 808,54
3 LN=PEEK(43)+256*PEEK(44)+12
4 FOR J=0 TO 64:READ X:T=T+X
5 POKE LN+J,X :NEXT
6 IF T<>6787 THEN PRINT"DATA ERROR!":END
7 :
10 DATA 169,83,133,34,165,44,133,35
11 DATA 133,2,165,2,10,10,56,101
12 DATA 2,133,2,160,1,177,34,240
13 DATA 16,197,2,240,4,69,2,145
14 DATA 34,230,34,208,229,230,35,208
15 DATA 225,200,177,34,200,17,34,240
16 DATA 13,24,169,5,101,34,133,34
17 DATA 144,208,230,35,176,204,96,5,142
18 :
19 :
100 FOR J=1 TO 50
110 PRINT J,J*J,SQR(J)
120 NEXT J
200 REM - RECODE SYS LN
```

```
B*
   PC  SR AC XR YR SP
.;0008 33 00 00 03 F6
.
080D A9 53      LDA #$53
080F 85 22      STA $22
0811 A5 2C      LDA $2C
0813 85 23      STA $23
0815 85 02      STA $02
0817 A5 02      LDA $02
0819 0A         ASL
081A 0A         ASL
081B 38         SEC
081C 65 02      ADC $02
081E 85 02      STA $02
0820 A0 01      LDY #$01
0822 B1 22      LDA ($22),Y
0824 F0 10      BEQ $0836
0826 C5 02      CMP $02
0828 F0 04      BEQ $082E
082A 45 02      EOR $02
082C 91 22      STA ($22),Y
082E E6 22      INC $22
0830 D0 E5      BNE $0817
0832 E6 23      INC $23
0834 D0 E1      BNE $0817
0836 C8         INY
0837 B1 22      LDA ($22),Y
0839 C8         INY
083A 11 22      ORA ($22),Y
083C F0 0D      BEQ $084B
083E 18         CLC
083F A9 05      LDA #$05
0841 65 22      ADC $22
0843 85 22      STA $22
0845 90 D0      BCC $0817
0847 E6 23      INC $23
0849 B0 CC      BCS $0817
084B 60         RTS
084C 05 8E      ORA $8E
```

and after a slight pause, whilst the data is read back, the program will be converted to its original form and will run as normal.

Obviously, to save a program in its encoded form all you have to do is make a call to SYS 2061 and then save it. After it has been loaded back the call to SYS 2061 will read in and then activate the code which will do the conversion job before running the program. If you wish to stop people breaking into the program you can activate the RUN/STOP disable by removing the REM part from line two and recode the program as soon as it has ended by the SYS call in line 200.

To hide the SYS call completely then adopt the following procedure.

1. Make a new line reading 0 SYS2082: REM"" and press RETURN. Now place the cursor over the second of the quote marks and press SHIFT+INST 14 times to open up a gap of 14 spaces. Now just press DEL 14 times which just involves taking your finger off the SHIFT key and a reverse T (delete) sign will appear. When the cursor is flashing over the last quote mark press space and RETURN.
2. Remove the SYS call in line one but keep the REM statement intact.
3. Make the 12 in line three a 33, the checksum in line six, 6808 and the 83 in line 10,104. Now RUN2 as before and remember that the new SYS call is 2082 not 2061. On listing, line 0 will appear but be flashed off before it can be read by anyone!

# Teacher's Pet

**Margaret Webb, our resident school mistress, demonstrates how music packages can be educational as well as fun.**

ONE OF MY GREATEST DREADS IS waking up on Christmas morning to discover that some kindly relative has given one of the children a trumpet or drum-kit. It's not that I'm anti-music. In fact, I believe that music is an important part of life and the playing of an instrument is a great skill. However, there are lots of computer packages that are more versatile than the aforesaid instruments and are quieter. The programs range from a pre-school package through to one which offers the capabilities of a synthesiser.

You may be aware that there are a range of powerful systems using keyboards driven by the MIDI interface. Most of these systems are rather expensive and outside my field of interest. All of the packages discussed here cost less than £30 and only one offers a MIDI facility. Notwithstanding their lower prices, many of these programs offer useful facilities.

I have carefully chosen a range of software which encompasses a range of age groups and prices. Since you may wish to use this article as a possible shopping list, I have used price to categorise the software.

## Under £10

*Make Music with Mistertronic* by Mastertronic is the cheapest of the packages I want to describe but notwithstanding this, it's very good value. The program provides an aid to composing music. The complexity of music possible is a little limited by the fact that a single stave is offered with a maximum of one voice. Up to seven screen lengths of music may be written and saved to tape as required.

Five different sounds are provided — piano, guitar, trumpet, recorder and trombone. The actual sounds are only approximate but sound passable. The full range of simple note values and rests are provided and a useful option is provided to enable you to make hard copies of the score.

Overall this is a cheap and very cheerful program which works well and provides a simple but effective means to create music.

Fisher-Price's *Song Maker* is one of a series of high quality cartridge based packages from this toy maker firm. The child is presented with a list of music titles to chose from. This selection is made with a joystick. The musical pieces range through well known nursery rhymes such as Twinkle Twinkle Little Star and Pop Goes the Weasel, Play School favourites such as Row Your Boat and Farmer in the Dell and songs such as Frère Jacques and Campdown Races. Overall there are 20 titles plus an option for the child to create an original tune.

Though at first sight this program may seem to be purely a play item, it does have an element of education. As the tune is played, a simple score is shown on the screen. Initially each note is represented by the normal notation allowing the child to see the relationship between the pitch of a note and its position on the musical stave. The child can then overprint any note by an animal shape. Each animal actually represents a different voice or sound. Danny the Duck quacks a note, Betsy Bee buzzes, Oliver Octopus rings a bell, Marty Monkey uses his tail as a violin and Wilbur Whale plays a note on his water spout. Using the joystick, the child can change the voice playing any specific note.

This game offers hours of fun whilst subtly reinforcing the educational aspect.

*The Music Machine* cassette by Longman Software is joystick or keyboard controlled and is aimed at the over eights. It is, however, simple enough for younger children to use. The program allows the child to compose tunes using a cartoon man who holds the note and is guided into the correct position on the chosen stave. Rather than allow random music, however, the program forces the use of the constituent notes of simple chords. Not only does this allow interesting compositions, but a feel for the tonal structure of music is given. Only two sections of stave are given but by use of the ternary form of repeat (i.e. AABA where A is stave 1 and B is stave 2) but options are given to chose the key (C,F and G) and the tempo (march of waltz).

There is a basic teaching element in this program and a test sequence provided, but in spite of this, the game gives hours of fun.

SONG MAKER
Fisher-Price

MUSIC MACHINE
COMMODORE 64
INSTANT MUSIC MAKING
LONGMAN SOFTWARE

## £10 to £20

*The Music Studio* by Activision moves away from the strict teaching angle towards composition and musical theory. This package provides the environment for the detailed manipulation of up to three voices and their incorporation in musical scores. Two distinct options are offered. For the semi serious user, there is a versatile music editor. For those seeking to simply create tunes without emphasis on musical accuracy, there is the music paint box.

In keeping with modern trends, the program uses icons with a pointer to select options. This system is simple to use and easy to understand.

Up to 15 preset sounds are available, each denoted by a colour. These are selected by simply pointing at the corresponding colour on the note pallet.

This idea of tonal colours is most emphasised in the paint box. In this option you put the notes of your choice on the treble or bass staves. Rather than use the full note shapes, notes are simply shown as coloured blocks with sizes proportional to the duration. You can edit or change the composition and readily play it back.

The music editor is similar in many respects to the paint box but offers many of the facilities of music. Full notation is used and there are options for the full range of note values, accidentals (sharps, flats etc.), tied notes, dotted notes and rests. The system acts rather like a word processor with commands to copy and move phrases.

The value of both sections is that the music scrolls as it plays showing how sequences of notes sound — always a difficult step when trying to read music. A sound engineer section allows the manipulation of almost all aspects of the voices enabling you to create almost any sound. Finally, options are given to save music, include lyrics and make a hard copy on a printer.

This is an excellent and complex package which will appeal to users of all ages.

*Music Construction Set* from Electronic Arts is a disk based package and is similar in many respects to the Activision program. Again an icon driven system is provided by which you take notes and place them on the musical staves. There are 13 preset voices provided ranging from harpsichord and oboe thorugh to drum and flute. There is no facility to edit the sounds but the presets provided are useful and effective. The general feel of this package is of greater musical accuracy with a more serious flavour. Several time signatures are supported and a counter lets you know if you try to stuff in too many notes per bar.

The disk is full of excellent demonstration pieces. To test the brain, a mystery quiz is provided.

Both this package and the Activision program offer more limited educational facilities in themselves. Where they do score, is as supplimentary tools for use in connection with study of musical theory. As such, they are really of most value for children above eight years old.

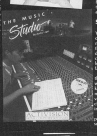
*Music Master* by Supersoft returns to the idea of using the computer as a musical instrument. In effect the program turns your C64 (and C16) into a synthesiser with a rhythm generator and a sequencer.

Graphically this package isn't as strong as some of the others, but in many ways it's more powerful. Most operations are performed by specific screens with instructions provided at every step. There are also three help screens.

The package comes in two main sections. First you have a real time synthesiser where the keyboard can be used to play notes on up to three voices. Full control over the voices is provided with the ability to make them interact in an almost infinite manner. Using this facility you can create the most mind boggling sounds. A rhythm is provided which will drive up to two of the voices allowing you to play to an accompaniment. This is great fun.

In a manner similar to the Activision and Electronic Arts packages, the program can be used to compose music. True musical notation is not used but the system acts more like a sequencer remembering a sequence of notes.

64
SUPERSOFT
FOR THE COMMODORE 64
MUSIC MASTER



## Over £25

*Commodore Music Maker* by Commodore SFX is marketed as a music maker for beginners and musicians alike. It comprises of a plastic keyboard which clips over the computer. The keys actuate the top two rows of the computer keyboard providing the means of generating sound. The package also includes some software and a tutor.

The software effectively turns the 64 into an electric organ rather than a synthesiser. Using the function keys you can control the octave used, select monophonic or polyphonic and alter the sound of the voices. The means of changing the voices isn't very easy to use but it works after a fashion. A simple sequencer is provided to allow you to create and save compositions.

A keyboard tutor is provided in the package. This gently eases the learner through the stages of learning about music, the relationship between the keyboard and the score and musical notation. The tutor consists of 27 tunes starting with a very simple Au Clair de la Lune and finishing with Amazing Grace with its key changes and accidentals.

There is a series of tutorials to go with the *Music Maker* keyboard covering a variety of musical tastes — everything from the Beatles to Classics.

Another piece of software to go with the keyboard is the Playalong Series of Albums. These are cassette and booklet sets which allow the user to play along with programmed tunes. One album is a selection of popular classics ranging from Eine Kleine Nachtmusik to the March of the Toreadors. Others include Beatles hits and Bruce Springsteen.

## Summing Up

Your choice of package depends not only on the cost but what you want from it. The majority of the software described allows the creation of musical scores albeit to differing degrees of complexity. The best course of action is to try them out at your local shop, if possible, and weigh up the facilities against your needs.

The play along types of program are in the minority but they offer more for those who simply want to have fun at the keyboard without the need to learn music. These also have an educational value since by playing with the notes, the child will pick up a feel for tonal and the inter-relationships between notes.

Surprisingly, only the Supersoft package offers both facilities — and does so quite well.

Since the dawn of the computer age the prices of home computers have been steadily falling.

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AS A COMMODO
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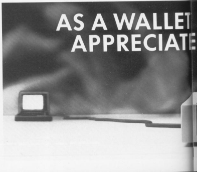
To put the Triton Quick Drive through its paces we used an ordinary computer game – Jet Set Willy.

From tape it took 170 seconds to load.

When loaded from the Triton Quick Disk it took a mere seven seconds. That is 163 seconds less than the tape and certainly as quick as most disk drives on the market.



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AS TEST DRIVEN BY THE EXPERTS.

New it may be, but the Triton Quick Disk is already receiving rave reviews in the computer press. For example, in a recent Home Computing Weekly article it picked up their much coveted "Flipped" award.

As their journalist said "..., I am very impressed by the Quick Disk. Not only is it very quick, and both smaller and neater than other drives, but it's easier to use as well...the Quick Drive performed faultlessly.

It's easy to use and at around £120 is probably the best buy for the first time user."

High praise indeed for any disk drive.

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## STEALTH

**Ariolasoft £9.95**

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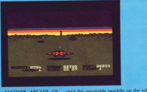


STEALTH IS ANOTHER ARCADE OFfering from Ariolasoft in collaboration with Broderbund.

You are in command of a Stealth starfighter sent from Earth to destroy one Dark Tower which is the nerve centre of a formidable force governed by the mysterious and evil "Council of nine".

You have been sent to this strange and forbidding planet to destroy this tower so as to protect the Earth, as our green and sometimes not so pleasant land is to be their next target of domination.

After loading the game you will see a screen filled with the baddies you will have to face if you are to succeed in your mission, with their respective points for their decimation. One of the good things about this game is that you don't have to read the inevitable twaddle on the inlay card and if you do I'm sure, like me, you will also find said twaddle to be not too short of misleading, but I suppose Ariolasoft'would argue poetic licence.

The game starts with the rear end view of your Stealth starfighter hovering just above the surface of this forbidding planet, which is a lovely vivid green and to my mind doesn't look at all forbidding. To make the ship go faster you just push the joystick forward and as you do so you will notice that the distance read out display counts down faster. This, as you have probably already worked out, is how far you have to go before you are in a position to deal the final blow on the tower which you can see on the horizon and which doesn't appear to get any closer even though the read out tells you that it should.

As you hurtle towards it, the council of nine (presumably) chuck every piece of destructive hardware at their disposal in your direction. In addition to this there are certain "natural" hazards which you must contend with, like anti-energy clouds and on the higher levels active volcanoes. As you are hit by the defending fire-power and you fly through the anti-energy clouds, your power level is reduced. It also diminshes as you proceed and shoot back. The state of your energy is displayed on the screen at all times and when it gets to a terminally low level the read out flashes, which unless you can find a positive energy field to fly through, heralds your demise.

If you have been able to avoid all these malignant forces you will notice that the distance reading will eventually flash at zero and all you have to do is blast the tower which, if you're successful will disappear in a cloud of smoke and spewing rubble, whereupon you lose control as your starfighter glides off into the somewhat bizarre sunset warping to the next level where you regain control and the nasties are nastier.

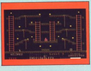
In short, Stealth is by and large (what a stupid expression – but you know what I mean) a good game. It is very "playable" and to the beginner ideal as an introduction to the shoot-'em-up world but I can't see it holding the attention of any seasoned campaigner for too long.

**D.F.**

## WIZARD

**Ariolasoft £9.99**

7 8 6 6



WIZARD IS YET ANOTHER PLATFORM, jump and collect game to hit the streets and it will undoubtedly appeal to those of you who appreciate a little strategy in an arcade game.

As the program loads you are welcomed to Wizard and told to "prepare to wield the joystick" and attempt to explore the various levels within. The tools are your agility, cunning and magic.

You are first given a choice of demonstration, playing the game or constructing your own game – which gives you full control of everything from the placement of your wizard to the amount of meanies and walls you're up against. All very clever stuff, but I would advise looking at the demonstration and playing the game before you start creating your own havoc because things do get just a shade weird as you progress throughout the various levels.

Before play starts you are asked to select level, number of players and speed once done a mere flick of the fire button brings your wizard to life. The basic idea of this game is indeed a simple one. You must proceed along the platforms, up and down rope ladders and lifts, collecting goodies while hunting for a key which you must take to a lock to get you through to the next level.

This first level completed, you are next introduced to your first ghoul which chases you around in the effort to end your mystical life. A nice touch here is that when you do expire and tumble to the base of the screen your wizard's hat falls off and he ends up on his butt with stars floating above his head.

The graphics are quite simple but effective and the levels of play do get harder as there are more baddies to contend with which present new problems as you go.

At £9.99, I think it's a bit overpriced for what it is especially since, if it was less expensive, I think it would be worth a look.

**D.F.**

## Karateka

**Ariolasoft £9.95**

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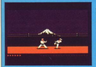


EVEN A SUPERLATIVE HOME COMputer such as the C64 has limitations and this game demonstrates its graphics capabilities to best advantage but at the inevitable cost of speed. The animation is by far the best I have seen but these movements are reminiscent of the slow motion sequences in a Bruce Lee film.

As a karate expert (the karateka of the title) you have undertaken the task of releasing the imprisoned Princess Mariko from the dungeon deep inside the castle of Lord Akuma. Each section of the game is loaded separately from tape and the first sequence shows the imprisonment of the Princess in a sequence worthy of any cartoon on television.

The first action screen takes up the story from the point where the karateka hauls himself up over the edge of the cliff upon which the castle stands. Immeditely before him is the gate to the castle courtyard and a guard readied for combat. Fortunately for our hero this henchman of Akuma is relatively unskilled in the art of karate and soon you are on your way past his huddled corpse, running through the courtyard prepared to fight your way to the side of the princess.

There are two modes for our fighter in this game, one is the fighting position and the other is running. Woe betide the karateka who inadvertantly runs into a guard unprepared for battle; the first blow is always fatal and with only one life to lose his years of training will prove fruitless.

After gaining entry to the castle more guards are encountered but these battles are often preceded by an attack from Lord Akuma's trained bird of prey which will deplete your stamina unless you kick or punch your way out of trouble.

Successfully fighting your way through the main hall brings you to a challenge which helps to set this game above the plethora of karate simulations which appear to be flooding the market at the moment. You are faced with the problem of passing a bamboo curtain which acts like a portcullis. The unwary karateka meets a sticky end and at this point under the sharpened stems of the curtain and a little thought is required to pass this barrier.

The next phase lies still deeper in the castle. Even the Princess has heard the stirrings outside her prison and hope springs anew. The next opponent is a grim faced man, a karateka of immense ability whose defeat leads you to a doorway which is apparently impenetrable. Each attempt to rush through results in a loss of stamina and much thought and forward planning is required to breach this barrier.

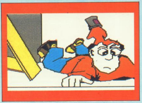
For my money Karateka far outstrips any karate game which I have played, including Melbourne House's highly successful Exploding Fist. Despite the slow reaction of the main character, I found myself too involved in ding dong battles to notice. If I were to suggest a top 10 of C64 games essential to anyone's collection this would certainly feature if only for the quality of the graphics.

**E.D.**

## TERRORMOLINOS

**Melbourne House £7.95**

💡 10 🕹 6 ▨ 8 💰 9



IT HAS TAKEN SOME TIME FOR THE authors of Hampstead to come up with their next offering but I can assure you that Terrormolinos is at least as sarcastically annoying as its predecessor.

The object of this "well crucial" adventure is to survive two weeks in the God-forsaken hole called Terrormolinos and take 10 (good) holiday snaps to prove you've suffered it, cos believe me when you've only got to the front door you're going to need a holiday!

The game starts with you as husband and father (the authors are obviously chauvanistic) at home doing the packing which you've left till the last minute while the taxi is on its way to take you to the airport. Simple, you may think, but there are certain things you have to find before you will even be allowed in the taxi, which presents a problem as the arrival of the taxi, to a certain extent, heralds the end of your packing time, and if you haven't finished your packing or, conversely, if you've packed too much, the taxi will drive off and leave you and that will be the end of your horroday. As you proceed through the game you will experience some quite funny pictures which are displayed when either you have made a fatal mistake or you want to recall one of your snaps to find out if its a good one. This is important as you only have a film with 12 exposures and, as already mentioned, you've got to take 10 pics to win the game – that is if you accept that there are any winners in a game like this.

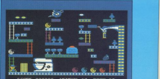
In short this adventure is everything you would expect from the chaps that created Hampstead and I'd like to congratulate them on not only a great follow up but allowing us all into the secret of what a good holiday is not about.

**D.F.**

## HENRY'S HOUSE AND FRIENDS

**English Software £6.95**

| Originality | Playability | Graphics | Value For Money |
|---|---|---|---|
| 7 | 8 | 9 | 9 |



HENRY'S HOUSE AND FRIENDS IS, AS the name suggests, a compilation package, from English Software, comprising four of the old favourites.

Three are arcade games and the last one, Stranded, is an adventure with graphics not too dissimilar to Level Nines' game, but unfortunately that's where the similarity ends.

They have been presented on one cassette with two games on either side. Side one carries Henry's House and Jet-Boot Jack, both of which are platform games which are even at the lower levels quite difficult.

In Henry's House you find yourself as little Henry in the clothes cupboard of the royal household. I wonder if ol' Di knows what the little horror is up to, bless his little spun-gold socks, but if she doesn't you'll find out when you play the game.

Your task is to guide Henry round the screen collecting various goodies and avoiding some really gruesome obstacles, like boots which, if you're not quick enough, stamp on the little chap, so you (and HRH of course) can proceed to the next level. It's a good game with really good graphics but it needs some perseverance as the collision detection can only be described as fierce, which is something I found with all three arcade games in this bundle.

Next is Jet-Boot Jack. It's much the same as the previous game but I didn't think it was as good, although it is quite difficult to get used to, and therefore well worth playing.

Jack is a musical fiend and with jet-boots flaming he zips up and down lifts and along slides in an attempt to amass the largest music collection in the galaxy. This you can safely assume is not without its obstructions, namely bugs and gremlins who are bent on stopping the intrepid Jack. These little blighters are disposed of by jumping up and down on the platform above them till they lose their grip and fall to their doom.

That's one side of the tape done. On the other side is the adventure Stranded and another arcade game called Neptune's Daughters.

The adventure isn't that good, basically due to its complete lack of any atmospheric descriptions and its infuriatingly small vocabulary. It is to say the least completely uninspiring, but I suppose its a good break from all that climbing, collecting, and zapping you get in the other three.

Neptune's daughters is a sub-aquatic maze game where your task is to rescue the daughter who has been captured by the evil Sea Serpent. To do this you must face various hazards such as deadly sucker plants, swarms of amoeba, monster crabs and an indestructable octopus. This, as I'm sure you can imagine is all great fun.

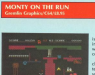
H.H. and friends is as a package well worth looking into. It will give hours of fun at a reasonable price. An ideal family entertainment substitute for those boring film repeats at Christmas time – besides with four games on one tape it'll save space.

**D.F.**

## MONTY ON THE RUN

**Gremlin Graphics/C64/£8.95**

| Originality | Playability | Graphics | Value For Money |
|---|---|---|---|
| 3 | 9 | 7 | 9 |



Monty's out! After breaking jail in Monty Mole, this game picks up the story of his life on the outside.

As you might imagine, Monty's world is just as full of hazards as his imprisonment was and a nimble joystick will be needed if you are to help him complete his escape.

Each screen is filled with crashing clocks, bouncing beasts and tumbling terrors. Add to this the accompaniment of some of the best music I have heard in a game and the stage is set for fun and excitement.

One feature which lifts this out of the humdrum melee of platform games is Monty's Freedom Kit. At various points in the game Monty will reach impassible barriers, impassible that is if the correct item is not in Monty's Kit.

The list of objects for use in the kit consists of over 20 potentially useful items but only five of them can be used. My favourite choices are the ladder and the barrel of rum. With these items you can at least guarantee that if Monty gets stuck he can always climb the ladder, jump into the rum and go out smiling. The graphics for the game are quite varied but it is obvious that it is a conversion from the original Spectrum version though a few extra trimmings have been added to improve the look of it.

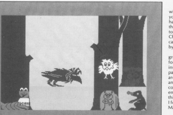
The animation of Monty is rather cute. Instead of jumping he somersaults everywhere throughout this fascinating game.

**J.G.**

## ORM AND CHEEP: THE BIRTHDAY PARTY/NARROW SQUEAKS

Macmillan Software £ each

Originality 6 Playability 6 Graphics 6 Value For Money 6



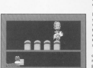
ORM AND CHEAP HAVE QUICKLY established themselves as firm favourites on ITV's children's programmes and their adventures are ideal for a computer game or two.

These two cassettes from Macmillan Software bring the whole cast to the computer screen in a series of games which should hold a child's interest for quite some time. The games are by no means simple to play and require quite, sophisticated mental abilities. On the other hand the control of all the games is the same and one key is all that is needed. This can be on the keyboard or joystick so anyone can play.

The Birthday Party is Orm's celebration but the guests have to be found. This is Cheep's job but first he must help Orm to find the ingredients for the birthday cake.

As Orm crawls under a shelf or jars a symbol appears which indicates the content of each jar in turn. When Orm reaches the edge of the screen a speech bubble appears with an ingredient symbol and Cheep hovers over each jar in turn. When you think he is over the correct jar, a keypress will reveal if you are right. If you are not all of the jars crash to the floor one by one and the game starts again.

The next challenge is to wander through a simple maze to find the other party goers; Mouse, Hedgehog and Snail. Mole is in his underground tunnels which form a second, more difficult maze to explore.



Finding the first three is quite easy except that Hedgehog tends to be trapped by one of the villains of the piece: Crow, Rat or Cat. If Cheep is accompanied by the correct combination of friends, each of their enemies will disappear.

Each junction has a signpost whose arms change colour one by one. When it points in the right direction you press a key and off Cheep goes.

Eventually the entrance to Mole's home is found and Cheep must enter alone, fine mole and get out again. At this point I would strongly advise mapping the maze because it is difficult to keep track of where you are.

Each tunnel leads to a small chamber with more tunnels leading from it. When you enter a new chamber the tunnel you have just used is always at the bottom of the screen so even using a map you have to turn it this way and that to follow Cheep's progress. To add to the complication, some of the tunnels are blocked by Rat, Cat and Crow.

Returning to the outside world the group makes its way back to Orm's house for the party. Orm is a little fusspot and insists that everyone sits down in a particular place. As you move each guest around the table Orm twitches his head and a beep is heard for each place which is correctly filled by a guest. Since Orm's empty space is also indicated by a beep this game can be difficult to play and even I found it a challenge. It's a bit like playing Mastermind.

Once you succeed, Orm disappears to get his cake and Crow pops his head in causing everyone to panic and change places at the table. This does not suit Orm when he returns and once again the guests have to be rearranged into a new order under his direction before the party can at last proceed.

The second cassette, Narrow Squeaks, has a different set of problems to be solved. It begins with Cheep trying to wake Orm by piling up crockery which then crashes into a broken pile. This certainly wakes Orm and I'm surprised Cheep doesn't end up as Coq au Vin after such appalling behaviour.

Next Orm is trapped by Crow and can only be rescued by watching the movements of his friends. When the pattern of movements change a keypress will cause Crow to move further away until he eventually disappears off the screen and Orm can escape.

The friends are then trapped in a tree hollow by Rat and Hedgehog to protect them as he guides them out. This means keeping him between Rat and his friend as they move across the screen.

Finally a flood has floated Orm away on his bed. As he is carried along by the flow he meets the enemies floating on branches. He must steer his way so that he just touches the edge of each branch, spilling the enemy into the water.

After each section a scoreboard is shown but, instead of giving a numerical score, of sections of a picture is revealed.

Both packages are nicely illustrated in graphics and sound but I did feel that one or two of the games were extremely difficult for a young audience though perhaps with parental advice this could teach skills which would not be learned so easily in any other medium.

## DONALD DUCK'S PLAYGROUND

**US Gold £9.95**

| Originality | Playability | Graphics | Value For Money |
|---|---|---|---|
| 7 | 5 | 7 | 7 |

WALT DISNEY'S SECOND MOST popular cartoon character paves the way for the much heralded education series distributed by US Gold.

Very American in flavour, this is an excellent vehicle for teaching children about the relationship between work, pay and spending in an ideal world. Well, an ideal Capitalist world anyway.

After selecting one of the three levels of play we find Donald in the high street with shops to the left and workshops to the right. Using a joystick you can guide him into any of these buildings but lacking money it's best to give the shops a miss and try a bit of good honest toil instead. No ducking the world of work, Donald.

The choice is between working in a signal box, a toy shop, produce makret (fruit and veg market to us) or at an airport.

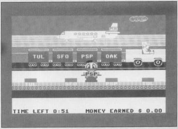
No matter which option you select the first task is to decide how long the job will last. Duration can be anything from one to eight minutes and as each job is completed a sum of money is added to Donald's earnings.

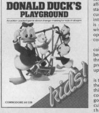
As a signalman, Donald must control six sets of points on a railway network to get the Amquack Express to its destination by the shortest possible route. Each time a journey is completed a new destination is indicated and so on until the time runs out.

The toy shop tests a child's skill at matching colours and shapes. A toy will appear on the conveyor belt to the right of the screen and Donald has to position a ladder by the correct column of shelves, collect the toy and then climb up and place the toy on the correct shelf. To add to the fun, the Amquack Express passes when a clock ticks down to zero and if Donald doesn't pull the shutters across all of the toys will fall off the shelves and smash to pieces.

Boxing fruit and vegetables is the task at the produce market. As each item is thrown from the back of a lorry, Donald must catch it and drop it in the correct box. If he misses a catch or drops the item in the wrong box Donald's voice is synthesised as he babbles his dissatisfaction. Is he quacking up I thought.

The final option is to be a porter at the airport. A conveyor belt carries boxes with three letters on them which relate to the letters on baggage cars being towed across the screen. With the kind of care and attention we've grown to expect from baggage handlers world wide, Donald is made to grab a box and throw it in the general direction of the relevant truck. If it lands in the correct one Donald earns some money; if it lands in the wrong one nothing is said. Just like the real world, isn't it?




WALT DISNEY
PERSONAL COMPUTER SOFTWARE
DONALD DUCK'S
PLAYGROUND
An action-packed game about change-making for kids of all ages
kids!
COMMODORE 64/128

Once a sum of money is earned Donald can go to the shop to buy various items to add to the playground for his nephews Huey, Dewey and Louie. The three shopkeepers are Mickey Mouse, Minnie and Goofy.

Each item for the playground has a price and Donald can flick through the catalogue until he finds something he can afford. The picture then shows Donald's stack of money and a till. Using an arrow cursor, coins can be moved one by one into the transaction square until the value is equal to or higher than the item he wishes to buy. If he needs change the till opens and you are invited to sort out the correct amount.

Care must be taken to select a sensible collection of items for the playground because it is three floors high so at least three ladders or cargo nets should be provided so that the nephews can climb up to play on the top levels.

One strong complaint I have to make is that all the money is in dollars. Granted the instructions state, rather feebly, that this was maintained because of the complexity of the program and that it's good to learn about other people's culture (is culture the correct word?). If the designer's are a group of educationalists they ought to understand that this kind of ploy can completely disassociate children from linking the game with the real world around them. Please US Gold request permission to change this (and the questions to Monster Trivia) and you will increase your turnover.

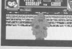
Despite this niggle the game is excellent and well structured. Potentially a useful learning tool.

**E.D.**

## FRANK BRUNO'S BOXING

**Elite Systems £7.95 (cass) £11.95 disk**

8 7 8 7



THE GLOVES ARE OFF IN THE BATTLE for the boxing simulation market and I predict that this is the one which will take the championship.

The game is quite complex to play requiring the use of either a joystick and the keyboard or two joysticks. This means that it would be best if you had a joystick which could be held down by rubber suckers but I'm sure that some of the inventive minds out there will find their own solution to the problem.

Playing the role of Frank Bruno, there are eight opponents to be defeated on your way to the World Championship. Each new fighter has an amusing name according to his nationality and they become progressively more skilled and difficult to beat as you rise in status. Each fighter must be beaten before you can go on to meet the next one. This is because of the security system. On winning a match you are given an Elite Video Boxing Association Membership Code which is calculated according to your initials. On selecting the load option from the menu, you are asked for this code before loading will take place.

The game is found on side one and the data for the boxers is located on side two of the cassette version. The only problem I found with this system is that the code is difficult to read but perseverence will eventually bring success.

The screen display is split horizontally and above the middle line you can see the score chart flanked by a cartoon portrait of both fighters, below the line is the boxing ring itself.

At first the range of movements are limited to ducking, dodging left or right, head punches and body punches. As each of Bruno's punches makes contact, a line moves across the bottom of the scoreboard towards a KO symbol. When this symbol is reached the meter flashes giving Bruno the ability to use his strong right hook and uppercut to floor his opponent.

Each bout is a one round fight and if either of the boxers hit the canvas three times within the round they are out for the count and the bout ends. This is the only way to decide a fight, a points decision is not catered for.

The view of the ring is an interesting one from behind Bruno. This makes a pleasant change from the usual lateral view that other versions use and is visually more dynamic. The opponents are monstrously large sprites and the quality of the game is very high indeed.

## PARADROID

**Hewson Consultants £7.95**

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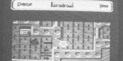


A PARASITIC ANDROID, OR INFLUENCE device as it is more correctly called, has been sent in to suppress or destroy the renegade androids on a large space freighter. Its communication system beams out a signal to your computer and from the image received it is possible to clear the decks of danger and repossess the ship.

As a follow up to the ultra-cute Gribbly's Day Out, this game displays the same smooth scrolling screen when the paradroid is moved around the decks.

A parasite needs a host as an energy source and this hi-tech device is no exception. When a droid is encountered the decision must be made whether to blast it with a burst from the twin laser guns or to suppress it. If the latter option is selected then the host droid will resist and the screen changes to show a circuit interface with the paradroid. At the top of the printed boards is a square which must be changed to the correct colour of your influence device if you are to succeed in gaining control. Failure results in an explosion which will destroy both host and parasite, taking you back to the start of the game.

Limited energy reserves make it essential to change host regularly or an alternative is to recharge at the power points scattered around the ship. To find these places often means logging on to one of themany computer links found on every deck. From here it is possible to call up a small scale map of the current level to see where the recharging stations are situated. It is also possible to display an overview of the arrangement of levels within the ship to plan your next move or gain information about the other droids.

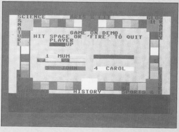
After blasting your way around a particular level the lights are automatically dimmed to indicate that there are no more droids around and it is time to find a lift to another floor where the whole process of blasting and parasitising starts again until the whole ship is cleared.

Although the programming is of a high standard and the concept is sound, I found the game to be a little monotonous. Hewson's describe the game as 'the thinking man's shoot-em-up' but I would expect a few more challenges before I'd accept that title.

**E.D.**

## TRIVIA UK

**Anirog /C64/£7.95**



Trivial Pursuits at a price everyone can afford courtesy of Anirog.

What you get for your money is a twin cassette pack containing the master program and plenty of questions to keep you busy but more than this, there is an editor program which allows you to create your own questions on tape.

The appearance of the game is fairly uninspiring and it is obviously written in Basic with no trimmings. This does not detract too much from the game and there are two redeeming features over any other version which I have seenn.

Firstly, the questions are tailored for the British market though they are not too demanding, more like a junior version of pursuits. For example, which player scored three goals for England in the 1966 World Cup Final and which famous DJ was once married to actress Tessa Wyatt?

Secondly, instead of typing the answers into the computer each player must call out his answer and on pressing a key the correct answer is revealed and the computer asks if you got it right. This eliminates problems such as entering World War II only to find that the computer says that you are wrong and that the answer is the Second World War. Of course this does not eliminate the work of nimble fingered cheats.

The questions fall into one of six categories and the board consists of a square ring of boxes each with a colour corresponding to one of these subject areas. The corner squares and the central square on the top and bottom rows are larger, bonus squares.

The computer rolls a dice to decide how many moves the current player can make, if the question is answered correctly, the player moves around the board. If the player is on a bonus square a piece of pie is awarded and the first player to collect six pieces is declared the winner on answering a question from a category chosen by his opponents.

The one serious drawback to this game is that it doesn't speed load the questions and it takes ages to load each block of questions (10-15 mins). Half way through a game the computer may have to load up another set which means another long wait. I hope there is a disk version on the way!

**J.G.**

## AXIS ASSASSIN

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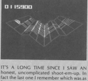

IT'S A LONG TIME SINCE I SAW AN honest, uncomplicated shoot-em-up. In fact the last one I remember which was as frantic as this was Gridrunner.

Arcade fanatics will be familiar with the scenario. A three dimensional grid disappears into the distance and various geometrically shaped objects work their way quickly towards you. You have a gun which runs along the near edge of thegrid and you have to take everything that's thrown at you.

In this version a small spider appears on the grid and weaves cross webs before the game starts. Then all hell breaks loose as various creatures hurtle along the grid switching lanes as they go. Some are intent on making it up to the edge that you are patrolling whilst others weave more cross webs.

If you find yourself in a sticky situation with one or more 'things' on your base line you can move down the grid turn and fire back at them. Although this kind of activity can be totally absorbing, you have to keep your wits about you and your eyes open because the web spinners will try to fill up a pathway and then it cannot be crossed so more of the dangerous kinds of creature can reach your row to menace you.

After a while, if you last long enough, a giant spider appears which is the signal to bolt down one of the channels firing like crazy until you shoot off the end and a new grid is drawn.

Each grid differs from the last in shape and poses fresh problems. One in particular can totally confuse you as to which way to move the joystick.

If you want a tip on how best to play this game I'll tell you. Keep firing and panic like crazy and with a bit of luck you'll win through.

**E.D.**

Value For Money

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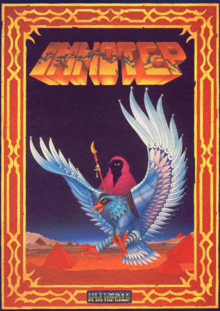
# COMMODORE 64



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# MACH 2

**Here's part two of our Machine Code Development System by Steve Carrie. This month we bring you the Macro Processor.**

## The Macro Processor

This month I will give listings of the Macro Processor and I'll also explain more about MACROs and their uses.

The Macro Processor is an "external" command file which is loaded by the Monitor and executed as if it was an internal command. The program resides in memory at 9000 hex. and is called at this address. The call command should contain the names of the files which are to be processed — more on this later.

Type in the four Basic listings given here. Again I suggest that you save them all before RUNning.

When they are ready, RUN them in sequence one to five, then save the generated program with the command:

```
POKE43,0:POKE44,144:POKE
45,32:POKE46,156:SAVE"
MACRO",8,1
POKE43,1:POKE44,8:NEW
```

or you can use the monitor S command giving MACRO,9000 and 9C20 as filename, first address and last address respectively. Either way, you should now have a copy of the finished program.

## Running the Macro Processor

The syntax of the external command for calling the Macro Processor is:

```
MACRO (sourcefile) (targetfile) (macrolibraryfile)
```

The macro libray file is optional and can be the name of a library file up to 8K in length. Note the spaces between each entry. These **must** be included. If file names are omitted from the command, the Macro Processor will request them by issuing the prompt ENTER FILENAME(s) whereupon you should enter the names of the files in the same format as above, without the command MACRO of course.

## Macros and their Uses

In a machine code program, there may be sections of code which are identical or nearly identical differing only in the operands. It can become rather tedious having to type in these copies of the same text. Wouldn't it be better to have some sort of "in-line" code generator which would accept some parameters and alter the text to suit?

This is basically what a MACRO is. A section of code which can be altered to suit a particular application. The programmer gives the MACRO a name and supplies parameters and the processor generates the code. MACROs may be kept in library files or appended onto the end of a program.

To make this a bit clearer, consider the following example. Suppose in a program, a sequence of three almost identical lines repeats itself on several different occasions. On one occasion it may be:

```
DELAY1   LDX          $FF
DEL1     DEX
         BNE          DEL1
```

and on another occasion it may be:

```
DELAY2   LDX ˙        $80
DEL2     DEX
         BNE          DEL2
```

As you can see, they are very similar, differing only in operands and symbols. For reference only, I will call the first example DELAY1 and the second DELAY2. These are actually the symbols used and not the name of the MACRO.

OK let's make this section of code a MACRO. To form a MACRO we have to define it by preceding the actual code with a couple of lines containing the name and any parameters used. A MACRO of our routine thus becomes:

```
         MAC
         : opening delimiter
L        DELCODE TIME
         : definition line
L        LDX          $TIME
         : actual code
DEL.SER  DEX
         BNE          DEL.SER
         MND
         : closing delimiter
```

Every MACRO has an opening and a closing delimiter. The definition line contains the name of the macro and any parameters used in the body of the routine itself. Here, L is a formal parameter for a label supplied by the MACRO call, TIME is a formal parameter for the actual delay amount and DELCODE is the name by which the MACRO is to be called.

Note that L is positioned in field 2 beside the first line of the routine. If a parameter is declared in a MACRO definition, then the actual parameter must be supplied in the call. An exception to this rule is the symbol parameter in field 2 (here, this is the L). If this is declared in the definition, it may or may not be in the call. However, if any MACRO call contains more parameters than are in the definition, an error will occur.

One other thing here. Notice the DEL.SER symbol. In this format, each time the MACRO is called this will generate a unique symbol by adding numbers onto the end of the DEL.

This number is a serial number which is incremented for each MACRO call. Thus, if the macro call is the first, this symbol will become DEL000 and if the call is the eighth, it will become DEL007.

Right, our MACRO is ready to be called. The format of the calling line is, in these cases:

```
DELAY1    DELCODE  FF and
DELAY2    DELCODE  80
```

Now, assuming our MACRO was to be called by the first of these two lines i.e. DELAY1 then the generated code would be:

```
DELAY1   LDX          $FF
DEL000   DEX
         BNE          DEL000
```

assuming that this was the first MACRO call.

Our second example, assuming it was the second MACRO call, would be:

```
DELAY2   LDX          $80
DEL001   DEX
         BNE          DEL001
```

If, in the MACRO call, we leave out the label as in:

```
DELCODE  FF
```

then the MACRO will be generated as:

```
        LDX     $FF
DEL002  DEX
        BNE     DEL002
```

assuming that this is the third MACRO to be called.

Let's try a program. When you have finished this example, keep the files that are created for next time when you will be able to assemble the code.

## A Programming Example

Before starting this example, make sure you have the Monitor/Editor and Macro Processor programs on the same disk and that you have made backup copies of them. Having a "working disk" with your utilities on it is by far the most convenient arrangement. If disaster strikes and you corrupt the disk, at least you will have a utility master disk as backup although you should of course backup any important source files too.

Another convenient thing is to have small loader program as the first file on your working disk. Thus when starting out, all you have to type is:

```
LOAD"*",8
RUN
```

and you'll load the Monitor.

A typical loader program, in Basic, would be:

```
10 A=A+1:1FA=2THENSYS
   33280
20 PRINT"LOADING MONI-
   TOR"
30 LOAD"MONITOR",8,1
```

Right now, on to the example. First, we will create a MACRO library file. MACRO definitions may be held at the end of a source program or in a library file. The latter is, I believe, the most convenient arrangement.

Load and enter the monitor. Now issue the command EDITOR to get into the Editor. In response to the prompt, type the filename MACLIB (short for MACRO library) and hit return. The message NEW FILE will appear. Type the comand A. The first linenumber will be printed and the cursor positioned at the start of field 2. Type in the following program. Remember that you can use the F1 key to TAB to the new field. As a guide, there is a heading giving the field numbers. Don't type it in!!

```
FIELD1    FIELD2     FIELD3    FIELD4
10                   MAC
20        L          GETLINE   PROMPT,POINTER
30        L          LDA         MAC.SER
40                   LDY         MAC-SER
50                   JSR       $AB1E
60                   JSR       $A560
70                   STX       POINTER
80                   STY       POINTER=1
90                   JMP       $B603
100       MAC.SER    TXT       PROMP
110                  BYT       0
120                  MND
```

When the line number 130 appears, hit return to cancel auto mode and type * to save

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NEW

the file and exit to the Monitor.

What this MACRO does is to generate code which, when assembled, will output a prompt given by the user parameter PROMPT and accept a line of input from the keyboard. When return is pressed, the start address of the area of memory where the input line has been stored by the BASIC ROM routine $A560 is put into a pair of locations given by the user parameter POINTER.

Now we will deal with the actual program. When it is finally assembled, it will:

1 Clear the screen
2 Print a prompt
3 Accept input from the keyboard
4 Print out what was typed in.

It will use the MACRO GETLINE for steps two and three. Don't worry too much about the meanings of the various instructions such as ORG and EQU. These will be explained when I deal with the assembler.

Again, there is a field heading to help you. Enter the Editor and give the filename as MACTEST. Enter auto-numbering mode and type the following:

```
FIELD1   FIELD2      FIELD3    FIELD4
10                   ORG       $C000
20       TEXTPOINT   EQU       $FB
30       CHROUT      EQU       $FFD2
40                   LDA        $93
50                   JSR       CHROUT
60                   JSR       LINEINPUT
70                   LDY        0
80       LOOP1       LDA       (TEXTPOINT),Y
90                   BEQ       END
100                  JSR       CHROUT
110                  INY
120                  BNE       LOOP1
130      END         RTS
140      LINEINPUT   GETLINE   YOUR-NAME,
                               TEXTPOINT
150                  END
```

Exit the editor using the * command and type DIR. You should now have two new files called MACLIB and MACTEST. To see them, use the TYPE command in the form TYPE MACLIB or TYPE MACTEST. The Monitor will list them directly to the screen. Note that the MACRO is to generate a subroutine and not, in this case, in-line code.

As you can see, the MACRO GETLINE is called in line 140. Notice the prompt parameter. Instead of spaces between the words, there are dashes. This is an unfortunate restriction imposed by the Macro Processor. Parameters must not contain spaces. Multiple parameters should be separated by commas. The Macro Processor will only allow characters which are relevant to the assembler to be passed through.

Right. Now we will process the file MACTEST. Give the following Monitor external command:

```
MACRO MACTEST MACOUT
MACLIB
```

Note that MACOUT is the name of the output file. The disk drive will activate and after a few moments, the screen will clear and the following message will appear.

```
COMMODORE 64 UTILITY
SERIES.
MACRO PROCESSOR V1.0
(C) 1985 S.D.C.
```

There will be much disk activity and, if all is well, the machine will re-enter the monitor. Type DIR and you should see that a file MACOUT has been created. Use the TYPE command to list the file to the screen. You should see that the processor has inserted the MACRO where the call was and that the parameters have been inserted in their correct places. Note that, because the Macro Processor performs a renumber on the file, the line numbers will be different. Keep this program for later assembly.

Now, if you have been given an error message by the processor, check your two source programs for mistakes. It has to be said that the error messages are not all they could be, but at least they are better than Sinclair-type numeric codes!

## Error Summary

There now follows a summary of error messages given by the Macro Processor. When an error is detected, the message is printed along with a line number, and the processing is aborted. The line number may not be all that truthful, so watch out!

| Error Message | Meaning |
|---|---|
| FIELD 2 LENGTH | All field 2 entries are limited to a maximum length of nine characters |
| ILLEGAL NESTING | this Macro Processor does not allow nested MACRO definitions. In other words, a second MAC was found before the first MND. Note that nested calls are allowed |
| UNDEF'D MACRO | the MACRO called does not exist |
| MACRO NAME | name is too long or it is of an illegal type |
| FIELD 3 LENGTH | same length conditions as field 2 apply to field 3 |
| FIELD 4 SYNTAX<br>MISSING DELIMITER | parameter syntax error<br>applys to field 4 only. Although field 4 may extend for 50 chars, each entry may only be up to nine chars long |
| MISSING PARAMETER | Field 4 again. There must be an equal number of actual and formal parameters in a MACRO. |
| NO SUCH PARAMETER | too many actual parameters given in a MACRO call |
| MISSING NAME | no MACRO name was given in the MACRO definition |
| FILE ERROR | there was a problem with the disk typically the write protect was on |
| PARAMETER STACK OVERFLOW | MACRO calls may be nested up to six levels. This error is gen if this limit is exceeded. |
| ILLEGAL SERIAL FORMAT | only the .SER format may be used to serialise a symbol |

Next month will come the assembler listings and a description of the various symbols, instructions, etc. You will also be able to assemble the example program given earlier and run it.

Macro Listing 1

```
10 DATA 76,7,151,147,13,67,79,77,7
7,79,68,79,82,69,32,54
20 DATA 52,32,85,84,73,76,73,84,89
,32,83,69,82,73,69,83
30 DATA 13,77,65,67,82,79,32,80,82
,79,67,69,83,83,79,82
40 DATA 32,86,49,46,48,13,40,67,41
,32,49,57,56,53,32,83
50 DATA 46,68,46,67,46,13,13,0,69,
78,84,69,82,32,70,73
60 DATA 76,69,78,65,77,69,40,83,41
,32,0,147,13,77,65,67
70 DATA 82,79,32,80,82,79,67,69,83
,83,79,82,32,69,82,82
80 DATA 79,82,32,76,79,71,13,13,0,
70,73,69,76,68,32,50
90 DATA 32,76,69,78,71,84,72,0,73,
76,76,69,71,65,76,32
100 DATA 78,69,83,84,73,78,71,0,85
,78,68,69,70,39,68,32
110 DATA 77,65,67,82,79,0,77,65,67
,82,79,32,78,65,77,69
120 DATA 0,70,73,69,76,68,32,51,32
,76,69,78,71,84,72,0
130 DATA 70,73,69,76,68,32,52,32,8
3,89,78,84,65,88,0,77
140 DATA 73,83,83,73,78,71,32,68,6
9,76,73,77,73,84,69,82
150 DATA 0,77,73,83,83,73,78,71,32
,80,65,82,65,77,69,84
160 DATA 69,82,0,78,79,32,83,85,67
,72,32,80,65,82,65,77
170 DATA 69,84,69,82,0,77,73,83,83
,73,78,71,32,78,65,77
180 DATA 69,0,70,73,76,69,32,69,82
,82,79,82,0,80,65,82
190 DATA 65,77,69,84,69,82,32,83,8
4,65,67,75,32,79,86,69
200 DATA 82,70,76,79,87,0,73,76,76
,69,71,65,76,32,83,69
210 DATA 82,73,65,76,32,70,79,82,7
7,65,84,0,0,0,121,144
220 DATA 136,144,152,144,166,144,1
77,144,192,144,207,144,225,144,243
,144
230 DATA 5,145,18,145,29,145,54,14
5,65,68,67,65,78,68,65,83
240 DATA 76,66,67,67,66,67,83,66,6
9,81,66,73,84,66,77,73
250 DATA 66,78,69,66,80,76,66,82,7
5,66,86,67,66,86,83,67
260 DATA 76,67,67,76,68,67,76,73,6
7,76,86,67,77,80,67,80
270 DATA 88,67,80,89,68,69,67,68,6
9,88,68,69,89,69,79,82
280 DATA 73,78,67,73,78,88,73,78,8
9,74,77,80,74,83,82,76
290 DATA 68,65,76,68,88,76,68,89,7
6,83,82,78,79,80,79,82
300 DATA 65,80,72,65,80,72,80,80,7
6,65,80,76,80,82,79,76
310 DATA 82,79,82,82,84,73,82,84,8
3,83,66,67,83,69,67,83
320 DATA 69,68,83,69,73,83,84,65,8
3,84,88,83,84,89,84,65
330 DATA 88,84,65,89,84,83,88,84,8
8,65,84,88,83,84,89,65
340 DATA 77,65,67,77,78,68,68,69,7
0,66,89,84,84,88,84,87
350 DATA 82,68,68,66,89,79,82,71,6
9,81,85,69,78,68,69,88
360 DATA 84,32,121,0,208,19,169,72
,160,144,32,30,171,32,96,165
370 DATA 134,122,132,123,32,115,0,
240,232,32,9,130,142,224,2,132
380 DATA 251,160,2,132,252,160,0,1
77,251,153,225,2,200,204,224,2
390 DATA 144,245,169,0,141,208,2,3
2,121,0,32,9,130,142,240,2
400 DATA 132,251,160,2,132,252,160
,0,177,251,153,241,2,200,204,240
410 DATA 2,144,245,32,121,0,240,25
,32,9,130,142,208,2,132,251
420 DATA 160,2,132,252,160,0,177,2
51,153,209,2,200,204,208,2,144
430 DATA 245,96,165,1,41,254,133,1
,96,165,1,9,1,133,1,96
440 DATA 169,12,141,32,208,169,6,1
41,134,2,169,3,160,144,76,30
450 DATA 171,160,0,177,122,170,200
,177,122,133,123,134,122,96,169,0
460 DATA 133,69,133,70,133,71,141,
64,3,141,80,3,141,96,3,160
470 DATA 4,177,122,153,60,3,240,27
,200,192,14,144,244,177,122,153
480 DATA 66,3,240,15,200,192,24,14
4,244,177,122,153,72,3,240,3
1000 FORS=36864 TO 37631
1010 READA:POKES,A
1020 NEXT
1030 PRINT"FINISHED"
```

Macro Listing 2

```
10 DATA 200,208,246,160,0,185,64,3
,32,30,130,144,10,200,192,10
20 DATA 144,243,162,1,76,215,150,2
01,46,240,242,201,64,240,238,132
30 DATA 69,201,0,240,38,160,0,185,
80,3,32,30,130,144,10,200
40 DATA 192,10,144,243,162,5,76,21
5,150,132,70,201,0,240,12,160
50 DATA 0,185,96,3,240,3,200,208,2
48,132,71,96,165,70,201,3
60 DATA 208,46,169,104,162,145,133
,61,134,62,162,0,160,0,177,61
70 DATA 217,80,3,208,6,200,192,3,1
44,244,96,232,224,67,240,16
80 DATA 165,61,24,105,3,133,61,165
,62,105,0,133,62,76,92,147
90 DATA 24,96,160,0,9,48,72,169,64
,145,253,200,104,145,253,200
100 DATA 96,169,12,24,101,253,133,
253,165,254,105,0,133,254,169,0
110 DATA 168,145,253,96,169,0,32,1
30,147,165,69,145,253,240,17,200
120 DATA 162,0,189,64,3,145,253,20
0,232,228,69,144,245,32,145,147
130 DATA 96,134,2,189,96,3,32,30,1
30,144,6,145,253,200,232,208
140 DATA 242,201,64,240,246,201,36
,240,242,201,60,240,238,201,62,240
150 DATA 234,201,35,240,230,201,39
,240,226,201,37,240,222,201,43,240
160 DATA 218,201,45,240,214,228,2,
240,14,132,93,138,56,229,2,160
170 DATA 2,145,253,164,93,56,96,20
1,0,208,2,24,96,162,6,76
180 DATA 215,150,165,71,240,41,162
,0,169,1,133,94,165,94,32,130
190 DATA 147,200,32,193,147,144,24
,200,32,145,147,230,94,189,96,3
200 DATA 240,13,201,44,208,4,232,7
6,28,148,162,6,76,215,150,96
210 DATA 169,0,162,198,133,253,134
,254,160,0,152,145,253,32,164,147
220 DATA 76,18,148,160,0,166,70,13
8,208,5,162,10,76,215,150,145
230 DATA 57,232,134,2,200,185,79,3
,145,57,200,196,2,144,246,160
240 DATA 10,165,59,145,57,200,165,
60,145,57,200,169,0,145,57,152
250 DATA 24,101,57,133,57,165,58,1
05,0,133,58,96,32,162,146,160
260 DATA 0,185,0,2,145,59,200,192,
4,144,246,185,0,2,145,59
270 DATA 240,3,200,208,246,200,152
,24,101,59,133,59,165,60,105,0
280 DATA 133,60,76,169,146,162,0,1
69,32,157,0,2,232,224,80,144
290 DATA 248,96,160,0,177,122,153,
0,2,200,192,4,144,246,96,160
300 DATA 0,162,4,165,69,240,12,185
,64,3,157,0,2,232,200,196
310 DATA 69,208,244,96,160,0,162,1
4,165,70,240,12,185,80,3,157
320 DATA 0,2,232,200,196,70,208,24
4,96,160,0,162,24,165,71,240
330 DATA 12,185,96,3,157,0,2,232,2
00,196,71,208,244,96,162,79
340 DATA 189,0,2,201,32,208,3,202,
208,246,232,169,0,157,0,2
350 DATA 96,169,0,162,198,133,90,1
34,91,96,169,12,24,101,90,133
360 DATA 90,165,91,105,0,133,91,96
,32,33,149,160,0,177,90,240
370 DATA 48,165,69,200,200,209,90,
208,34,200,162,0,177,90,221,64
380 DATA 3,208,24,200,232,228,69,1
44,243,160,0,177,90,153,64,3
390 DATA 200,177,90,153,64,3,200,1
32,69,56,96,32,42,149,76,59
400 DATA 149,24,96,162,255,160,255
,232,200,189,96,3,32,30,130,176
410 DATA 10,153,160,3,201,0,240,10
5,76,119,149,134,93,132,92,32
420 DATA 33,149,166,93,160,0,132,2
,177,90,208,24,166,93,164,92
430 DATA 189,96,3,32,30,130,144,20
9,153,160,3,201,0,240,66,200
440 DATA 232,76,160,149,200,200,17
7,90,133,94,200,189,96,3,209,90
450 DATA 208,53,200,232,230,2,165,
2,197,94,208,239,189,96,3,32
460 DATA 30,130,176,35,160,0,165,9
2,134,93,170,177,90,157,160,3
470 DATA 200,232,177,90,157,160,3,
232,134,92,164,92,166,93,76,121
480 DATA 149,200,132,71,76,255,149
,32,42,149,166,93,76,148,149,162
1000 FORS-37632 TO 38399
1010 READ A:POKES,A
1020 NEXT
1030 PRINT"FINISHED"
```

Macro Listing 3

```
10 DATA 0,189,160,3,157,96,3,232,2
28,71,144,245,96,32,181,148
20 DATA 32,207,148,32,228,148,32,2
49,148,32,14,149,76,140,148,169
30 DATA 0,162,192,133,57,134,58,16
9,0,133,18,169,0,162,160,133
40 DATA 59,134,60,96,165,43,166,44
,133,122,134,123,160,1,177,122
50 DATA 208,18,165,18,208,9,160,0,
152,145,59,200,145,59,96,162
60 DATA 7,76,215,150,32,206,146,16
5,18,208,40,32,76,147,144,72
70 DATA 224,56,240,9,224,57,208,64
,162,7,76,215,150,169,255,133
80 DATA 18,32,193,146,32,206,146,3
2,83,148,32,64,148,32,13,150
90 DATA 76,168,150,32,76,147,144,2
3,224,57,208,10,169,0,133,18
100 DATA 32,13,150,76,168,150,224,
56,208,5,162,2,76,215,150,32
110 DATA 56,149,32,115,149,32,13,1
50,32,193,146,76,60,150,133,34
120 DATA 134,35,24,160,1,177,34,24
0,29,160,4,200,177,34,208,251
130 DATA 200,152,101,34,170,160,0,
145,34,165,35,105,0,200,145,34
140 DATA 134,34,133,35,144,221,96,
138,10,72,169,91,160,144,32,30
150 DATA 171,104,170,189,76,145,18
8,77,145,32,30,171,169,32,32,210
160 DATA 255,160,2,177,122,133,57,
200,177,122,133,58,32,194,189,32
170 DATA 18,130,162,26,108,0,3,32,
176,146,32,36,130,32,49,146
180 DATA 32,31,150,173,208,2,240,3
5,169,1,162,8,160,255,32,186
190 DATA 255,173,208,2,162,209,160
,2,32,189,255,169,0,24,32,213
200 DATA 255,144,5,162,11,76,215,1
50,32,52,150,169,1,162,8,160
210 DATA 255,32,186,255,238,32,208
,173,224,2,162,225,160,2,32,189
220 DATA 255,169,0,24,32,213,255,1
44,5,162,11,76,215,150,32,52
230 DATA 150,238,32,208,32,162,146
,169,0,162,160,32,174,150,32,169
240 DATA 146,32,102,152,32,173,151
,32,235,151,32,204,151,32,204,151
250 DATA 32,204,255,32,240,151,144
,3,76,57,152,32,206,146,32,76
260 DATA 147,176,6,32,60,155,76,13
1,151,224,65,208,3,76,54,152
270 DATA 224,56,208,3,76,57,152,32
,230,152,76,131,151,173,224,2
280 DATA 162,225,160,2,32,189,255,
169,3,162,8,160,3,32,186,255
290 DATA 24,32,192,255,176,21,32,1
83,255,208,16,96,32,207,255,238
300 DATA 32,208,72,32,183,255,208,
2,104,96,104,32,227,151,162,11
310 DATA 76,215,150,32,204,255,169
,3,76,195,255,162,3,76,198,255
320 DATA 32,235,151,162,4,134,2,32
,204,151,141,0,2,32,204,151
330 DATA 141,1,2,201,0,240,42,32,2
04,151,141,2,2,32,204,151
340 DATA 141,3,2,32,204,151,166,2,
157,0,2,201,0,240,5,232
350 DATA 134,2,208,239,32,204,255,
169,0,162,2,133,122,134,123,24
360 DATA 96,32,204,255,56,96,32,23
0,152,32,227,151,160,0,152,145
370 DATA 73,200,145,73,200,152,24,
101,73,133,45,165,74,105,0,133
380 DATA 46,165,43,166,44,32,174,1
50,32,39,130,32,147,152,169,15
390 DATA 32,195,255,76,0,130,169,9
,133,98,133,99,133,100,165,43
400 DATA 166,44,133,73,134,74,160,
0,152,145,73,200,145,73,169,15
410 DATA 32,195,255,32,36,130,162,
15,32,201,255,169,73,32,210,255
420 DATA 76,204,255,160,1,177,43,2
08,1,96,162,0,189,241,2,157
430 DATA 163,3,232,236,240,2,144,2
44,232,232,232,142,240,2,169,64
440 DATA 160,48,162,58,141,160,3,1
40,161,3,142,162,3,173,240,2
450 DATA 162,160,160,3,32,189,255,
169,1,160,255,162,8,32,186,255
460 DATA 169,43,166,45,164,46,24,3
2,216,255,176,7,96,32,183,255
470 DATA 208,1,96,76,222,151,165,7
3,166,74,133,59,134,60,32,140
480 DATA 148,165,59,166,60,133,73,
134,74,169,4,160,2,32,30,171
1000 FORS=38400 TO 39167
1010 READ A:POKES,A
1020 NEXT
1030 PRINT"FINISHED"
```

**Macro Listing 4**

```
10 DATA 76,18,130,160,0,177,95,208
,7,230,95,208,2,230,96,96
20 DATA 169,12,24,101,95,133,95,16
5,96,105,0,133,96,76,5,153
30 DATA 165,95,166,96,133,253,134,
254,96,162,2,181,98,24,105,1
40 DATA 201,10,240,3,149,98,96,169
,0,149,98,202,16,237,96,169
50 DATA 0,162,192,133,57,134,58,16
2,0,160,0,177,57,208,5,162
60 DATA 3,76,215,150,177,57,197,70
,208,28,200,177,57,221,80,3
70 DATA 208,20,200,232,228,70,144,
243,160,10,177,57,170,200,177,57
80 DATA 133,58,134,57,56,96,169,12
,24,101,57,133,57,165,58,105
90 DATA 0,133,58,76,71,153,165,18,
10,10,170,32,162,146,160,0
100 DATA 177,57,157,0,197,232,200,
177,57,157,0,197,32,169,146,232
110 DATA 165,95,157,0,197,232,165,
96,157,0,197,96,165,18,10,10
120 DATA 170,189,0,197,133,57,232,
189,0,197,133,58,232,189,0,197
130 DATA 133,95,232,189,0,197,133,
96,96,32,162,146,160,0,177,57
140 DATA 170,200,177,57,133,58,134
,57,76,169,146,32,162,146,160,0
150 DATA 177,57,153,0,2,200,192,4,
144,246,177,57,153,0,2,240
160 DATA 3,200,208,246,169,0,162,2
,133,122,134,123,76,169,146,133
170 DATA 94,32,32,153,160,0,177,25
3,240,26,200,177,253,197,94,208
180 DATA 3,200.56,96,169,12,24,101
,253,133,253,165,254,105,0,133
190 DATA 254,76,4,154,165,94,201,4
8,240,5,162,8,76,215,150,24
200 DATA 96,165,69,240,48,173,64,3
,201,64,208,42,173,65,3,32
210 DATA 255,153,176,6,169,0,133,6
9,240,27,177,253,133,69,162,0
220 DATA 200,177,253,201,46,208,5,
138,168,76,117,154,157,64,3,200
230 DATA 232,228,69,144,236,96,160
,0,185,64,3,201,46,240,6,200
240 DATA 196,69,144,244,96,162,0,1
81,98,9,48,153,64,3,232,200
250 DATA 224,3,144,243,192,10,144,
5,162,1,76,215,150,132,69,96
260 DATA 165,71,240,24,160,255,162
,255,232,200,189,96,3,201,64,240
270 DATA 15,201,46,240,11,153,160,
3,201,0,208,236,200,132,71,96
280 DATA 134,93,132,92,201,46,240,
59,232,189,96,3,232,134,93,32
290 DATA 255,153,176,5,162,8,76,21
5,150,177,253,133,2,200,152,24
300 DATA 101,2,133,2,166,92,177,25
3,201,46,208,5,134,92,76,27
310 DATA 155,157,160,3,232,200,196
,2,144,236,134,92,166,93,164,92
320 DATA 76,154,154,232,189,96,3,2
01,83,208,25,232,189,96,3,201
330 DATA 69,208,17,232,189,96,3,20
1,82,208,9,232,189,96,3,32
340 DATA 30,130,144,5,162,13,76,21
5,150,134,93,162,0,164,92,181
350 DATA 98,9,48,153,160,3,200,232
,224,3,144,243,132,92,166,93
360 DATA 76,154,154,32,49,154,32,1
44,154,76,255,149,169,0,162,198
370 DATA 133,95,134,96,169,0,168,1
45,95,136,132,18,32,32,153,32
380 DATA 41,153,32,63,153,230,18,1
65,18,201,6,144,5,162,12,76
390 DATA 215,150,32,164,147,32,18,
148,165,18,201,1,144,3,32,238
400 DATA 155,32,201,153,32,219,153
,32,206,146,32,76,147,144,47,224
410 DATA 57,240,25,32,51,155,165,7
3,166,74,133,59,134,60,32,13
420 DATA 150,165,59,166,60,133,73,
134,74,76,113,155,32,41,153,198
430 DATA 18,165,18,201,255,208,1,9
6,32,172,153,76,116,155,32,134
440 DATA 153,32,3,153,76,76,155,16
0,0,177,59,240,48,200,177,59
450 DATA 197,2,208,25,200,162,0,17
7,59,200,132,93,164,92,145,253
460 DATA 200,132,92,232,224,10,176
,21,164,93,76,199,155,169,12,24
470 DATA 101,59,133,59,165,60,105,
0,133,60,76,183,155,96,166,18
480 DATA 202,138,10,10,170,232,232
,189,0,197,133,59,232,189,0,197
490 DATA 133,60,32,32,153,160,0,17
7,253,240,37,200,200,200,177,253
500 DATA 201,64,208,12,200,177,253
,133,2,136,136,132,92,32,183,155
510 DATA 169,12,24,101,253,133,253
,165,254,105,0,133,254,76,5,156
520 DATA 96
1000 FORS=39168 TO 39984
1010 READ A:POKES,A
1020 NEXT
1030 PRINT"FINISHED"
```

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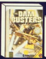
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# LANGUAGE LAB . ADA

**David Janda been put through his paces on First Software's ADA Training Course.**

UNLIKE PREVIOUS ISSUES IN WHICH I have featured one language and reviewed packages, this month I will concentrate on one package — the ADA Training Course. It's the only implementation of the ADA language currently available for the C64, but probably not the last.

The package is available from First Software on disk only. Readers should note that it is only a training course, and in no way can be considered as a full implementation of the language. Having said that, it is possible to compile ADA source into stand alone machine code.

## The Package

You pays your money and gets the goods. In the case of the ADA training course, that's quite a lot. The documentation consists of a 77 page instruction manual and tutorial which is packaged in a metal ring binder. The system disk contains numerous files including several ADA source examples, an editor, assembler and disassembler plus others.

At this point I must comment on the documentation which can best be described as poor. This is probably because since it was produced in West Germany, it has suffered in the translation to English. As it stands, it's very confusing with parts that are crystal clear, and others that are very hard to understand.

The documentation starts with a description of how to use the (very good) editor which is supplied with the package. After that, a section is devoted to each particular aspect of the ADA compiler i.e. loops, decisions, assignment and so on. There then follows some (not very well written) text on how the compiler operates. It takes several readings to appreciate (and understand) what the author is trying to say, but it's well worth the effort.

The final part of the documentation includes references to ADA grammer, a list of keywords and so on. This is probably the most confusing part of the documentation as there is no mention of the ADA keywords that are implemented in this version of the language.

The system disk contains 21 files in all. Six of which are source demonstration examples, plus a large ADA example in source and object code form. An editor is also supplied in the package. Unlike the Commodore editor, the ADA editor works on a line-by-line editing basis. The user interface allows the colour of the foreground/background to be changed and several disk operations can be carried out from within the editor.

Most of the compilation process is controlled by the editor, with the user being unaware that a lot is being done 'behind the scenes'. This includes the initial compilation which involves performing three comprehensive analytical tests on the ADA source code (more on this subject later).

The other files on the disk include an assembler which is used to produce a machine code file from the ADA assembly language file. A nice feature of the assembler is that it can be used for your own assembly programs as well. Also supplied is a disassembler, which although slow in operation is very handy. Instructions on how to use the assembler and disassembler are included in the ADA instruction manual.

## The Language

The ADA programming language was designed by committee. That is, instead of one man designing it, a working group thrashed out proposals over a number of years saying what the language should and should not incorporate.

As a result of this, the language specification is large — very large! And ADA is only available for mainframe computers. This new language has been adopted by the American Department of Defence (DoD) as its official language so ADA will probably become one of the primary programming languages of the near future. Anyone wishing to get a programming job in defence (or even civil scientific programming) could do themselves a favour by learning this language.

ADA itself is a high-level structured language which bears some resemblance to Pascal i.e. it is a block-structured language. As with all languages, ADA has a number of keywords (table 1), but the language also has packages. A package performs a specific set job. In the case of the ADA training course there are two packages, one for text handling (standard ADA), and the other for machine specific routines (non-standard). The two packages are called TEXT-10 and CBM-64.

Here is a very simple example of an ADA program.

```
procedure SIMPLE-PROG is
- - This is a comment
begin
null;
end SIMPLE-PROG;
```

The example itself achieves nothing, yet it does demonstrate some of ADA's features.

First, there are no line numbers used in ADA. Although the editor creates them for reference. Also notice that an ADA program can be entered in upper or lower case — it doesn't matter which.

The program is called SIMPLE-PROG and contains just one ADA statement 'null', which, as the name suggests does nothing! Notice how the procedure is enclosed with 'begin' and 'end', and how the procedure name follows the 'end'.

This example uses the TEXT-10 package.

```
with TEXT-10; use TEXT-10;
procedure DEMO is
begin
PUT("Hello    Your    Commodore
readers!");
end DEMO;
```

Notice how a package is declared before anything else in the program.

Data types in ADA are numerous, and the ones explained in the manual are real, integer and string. Constants may be declared from any of the types available.

Another aspect of the language is that ADA is a strongly typed language and will object if you try to assign an integer variable with a floating point value. There are however, methods of type conversion available.

```
with TEXT-10; use TEXT-10;
with CBM-64; use CMB-64;
procedure DECLAR is
 fixed  : constant integer:=1;
 flo    : constant float:=0.24;
 sent  : constant string:="Hello world";
 inter : integer;
 jim    : integer:=21;
 alphas,baker,delta : float:
 msg  : string;
begin
 null;
end DECLAR;
```

This example shows how variables can be assigned. Notice they can be assigned with an initial value when they are declared. The example also points out how indentation is allowed within the source program.

Decision handling is quite simple yet very versatile. The IF..THEN..ELSE construct is supported in the following manner.

```
if FRED > JIM then
 set of instructions
else
 another set of instructions
end if;
```

The example shows that a whole number of instructions can be placed between the IF and ELSE, or ELSE and END IF. If there is no alternative set of instructions to be executed, a simpler construct may be used.

```
if TOM = HARRY then
 do something
end if;
```

As is the case with Basic, a number of logical operators may be used in the comparison including; =, /= (meaning not equal to),<,<=,> and>=.

Flow of control is catered for by LOOP, and the more familiar FOR loop. Because there are no line numbers in ADA, it is necessary to reference by label.

```
FRED : loop
 a sequence of instructions
end loop FRED;
```

The example demonstrates that the loop has a label called FRED. The example above is a bit silly as it is an endless loop. A loop can be exited in the following manner.

```
FRED : loop
 instructions
 exit FRED when condition-is-met
end loop FRED;
```

It is a simple matter to include a loop counter within the loop and exit when the counter reaches the required value.

Another feature of ADA is that the loops can be nested.

```
TOM : loop
 instructions
 DICK : loop
  instructions
  exit TOM when condition-is-met
 end loop DICK;
end loop TOM;
```

From this you can see that it is possible to exit any level of loops by simply specifying the loop name.

A far simpler method of using loops is available by using the FOR loop.

```
for 1 in 1..10 loop
 number of instructions
end loop;
```

## Using the Compiler

The editor provided with the ADA tutorial can best be described as comprehensive. Not only does it allow programs to be loaded/saved to disk, but a directory can be displayed without disturbing any program currently in memory.

One of the options in the menu-drive editor is for compiling the source code, and this is where things start to get interesting!

The editor will ask whether you are sure, whether a trace will be required and whether the code should first be saved to disk (a wise thing to do!).

There then follow three analytical checks on the source code, which can take a long time, depending on the size of the source code. The first check to be performed is the lexical analysis which 'filters' the program and checks to see if the program contains words that it doesn't understand.

The next check is the syntactical analysis checks to see if the program follows the rules of ADA grammar. Should an error occur a detailed error message is displayed together with an option of displaying the contents of the stack. (ADA keywords have a value attached to them, and by observing the stack it is possible to see where the mistake has crept in).

When the lexical and syntactical checks are being performed, the screen displays the line number that is currently being examined.

The final 'check' is the semantic analysis which performs two operations. First it checks to see if your program makes 'sense', and secondly it produces an assembly language version of the source file. The assembly language is saved to disk and displayed on the screen or printer, together with the line number currently being produced.

The final stage of compilation involves assembling the file produced by the semantic analysis program. A 6510 machine code program is saved to disk and displayed on the screen whilst this is being done.

## Summary

The steps involved in compiling an ADA program may appear to be boring, but they are not. The idea behind the ADA tutorial is to give the user an understanding of ADA as well as the low-level aspects of compiler operation. The package, in my opinion, succeeds in doing this, and I can see many people having hours of fun just poking about the assembly files trying to match up the code with the ADA source.

Having said this, I must criticise the documentation that is supplied with the package. For £49.95 I believe people are entitled to expect a lot better than this. The manual is so vagbue, that I still don't know the number of keywords (listed in listing 1) in this version of ADA. Because of this, I would strongly recommend any potential buyer to purchase one of the ADA tutorial books which are now being published.

David Janda is prepared to enter into correspondence with regard to languages on the C64. He can be contacted on the following electronic mail services:
Prestel: 919992677
One-To-One: 13419001

## Table 1 — ADA Reserved Words

Please note that this list includes ADA keywords **not** supported by the compiler.
abort, accept, access, all, and, array, at, begin, body, case, constant, declare, delay, digits, do, else, elsif, end, entry, exception, exit, for, function, generic, goto, if, in, is, limited, loop, mod, new, not, null, of, or, others, out, package, programa, private, procedure, raise, range, record, rem, renames, return, reverse, select, separate, subtype, task, terminate, then, type, use, when, while, with, xor.

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# REFERENCE

**Find out how you can bring out the best in your C64 by browsing through this selection of books from the Your Commodore library.**

**Title:**
The Century Computer Programming Course for the Commodore 64
**Editors:**
Professor Peter Morse and Brian Hancock
**Publisher:**
Century Publishing
**Price:**
£10.95

THIS IS ESSENTIALLY A PROGRAMMER'S book and is a very good one indeed; although it is intended for those wishing to learn Basic it is also a good reference book for the more advanced programmer.

Peter Morse and Brian Hancock have edited the programs in a constructive and efficient manner and, apart from an introductory section to get you acquainted with your C64, the subsequent chapters follow a logical pattern.

Part two contains the essentials of Basic programming which are discussed in some detail with particular reference to 'flow charts' with accompanying programs based on such structural design. Here you will find a complete series of programming methods involving control with simple Basic statements.

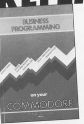
Arithmetic functions are well handled as are logical operations. At last we have a section on string handling and loops which will make sense to the beginner.

Subroutines, of course, are an integral part of Basic and good examples are given. All programs are quite unimaginative.

Part three is called the 'Complete Programming Method' and provides a great deal of theoretical data for your consideration involving design, control, decision structures and error trapping.

Colour, sound and sprites are not neglected and are adequately handled for a book of this size. There is a good section on high-resolution mode with big mapping and colour control.

Lists, arrays and sorting are not excluded and a brief resumé of Machine Code is given. In effect, this is quite sufficient, as M/C is a language of its own requiring much more detailed instructions; perhaps the authors might oblige in this field with an equally instructive book!!



Last of all there is an Appendix Section for reference plus a 'Program Library' – a mixed dozen of routines including two short games.

If your interests lie in structured programming then I would most certainly recommend this book – great value for the price.

E.M.

**Title:**
Commodore 64 Colour Graphics: A Beginner's Guide
**Authors:**
Shaffer and Shaffer
**Publisher:**
The Reston Computer Group
**Price:**
£14.50

THIS IS A REASONABLY WELL STRUCTURED book which is hidden amidst excessive rambling; there is far too much advice given on how to type in the programs and much of the program analysis is duplicated.

If you can ignore the superfluous 'chat flow' and get to the programs then you will find that you have, initially, a complete system for drawing and painting. Indeed the colourful frontpiece can be reproduced; this will take you through to chapter five with various side issues on the way about drawing triangles, squares etc.

However, let it be said that this is all done in Basic and is painfully slow. Your final picture will take some 15-20 minutes to appear on the screen – as pointed out by the authors.

A Toolbox is laboriously built up to enable you to do this. Fortunately it is listed in its complete form in Appendix B. The ZAP procedure is quite ingenious and will put you into drawing and painting mode by retaining all the subroutines.

The Toolbox also has a sprite handling routine which is fairly standard.

Gratefully, you can speed up all the drawing and painting routines which you have so carefully listed by going to Appendix D where you will find the speedy machine code numerical data listed with check-sum errors (six blocks of data). A routine is included to save pictures to tape or disk.

Well – the choice is yours between Basic and M/C. Obviously the latter is preferable so read the book thoroughly first of all and then make your decision. As the authors say 'stop, run the program and you're done'. Agreed!!

All programs are functional but the book is considerably overpriced.

E.M.

**Title:**
Filing Systems and Databases for the Commodore 64
**Authors:**
A.P. & D.J. Stephenson
**Publisher:**
Collins
**Price:**
£5.95

THIS BOOK IS A MUST FOR ANY C64 user who is interested in the more serious side of computing.

The authors will be familiar to Your Commodore readers for their succession of interesting and informative articles on various aspects of C64 use.

The book, overall, is easy to read and packed full of information. The style makes it suitable for all levels of user from novice to would-be expert. All but the most knowledgeable can learn from it.

There are one or two "Michael Caines" in it, such as – did you know that "the first stored-program computer was constructed at Cambridge University in 1949?" and "we have to thank an IBM engineer called Shugart for the development of the floppy disk"? Not a lot of people know that!

The Stephensons have extended user friendliness to the text of their book and provide enough diagrams, explanations and examples to make a complex and potentially dry subject very straightforward and interesting.

Example programs are used throughout the book to illustrate the various processes, becoming increasingly sophisticated as you progress.

By the time you have reached Chapter four you will know how a filing system is created and maintained. So much food for thought is provided that you will be tempted to get straight to the keyboard and start creating. However, there are more gems to come…

Avoiding dry academic analysis, Chapter five deals very succinctly with searches and sorts, culminating in an impressive machine code routine which handles two-dimensional string array sorts at a great rate of knots.

The ensuing Chapters give a good description of file structures, explaining the pros and cons of the various types – again, in language which is plain enough for a newcomer to grasp and sufficiently in-depth to satisfy even the experts. Once more, there are useful program routines to expand upon the text.

The appendices incorporate a true glossary and a list of 6502 mnemonics.

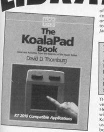
A nice touch is the self-test section at the end of each Chapter. A good guide to whether you have understood the content.

All in all, this book should prove a great asset to any C64 user who wishes to progress from playing games to making serious home/business use of the C64 or to anyone who wants to customise a filing/database system currently in use but does not fully appreciate the intricacies of data handling in relation to computer disks and tapes.

This book achieves all it sets out to do – a comprehensive prospectus of the basic sort/file techniques available on the C64, giving simple but instructive guides to efficiency whether using 1541 units or tape drives.

Thoroughly recommended! In my opinion – great value, well presented, full of useful hints, tips, and information. My copy will remain in a prominent position on my bookshelf alongside such weighty tomes as *"The Wilt Alternative"* and *"I, Jan Cremer"*.

**D.C.**


The KoalaPad Book
Ideas and Activities from the Inventor of the Touch Tablet
David D. Thornburg
KT 2010 Compatible Applications

**Title:**
The Koala Pad Book
**Author:**
David D. Thornberg
**Publisher:**
Addison Wesley
**Price:**
£12.95

THIS BOOK WAS WRITTEN BY THE INventor of the touch tablet or Koala Pad. He has an axe to grind in the sense of wishing to promote the idea that that Koala Pad is all things to all computer users but in keeping with his earlier books, on graphics and LOGO, he has resisted the temptation to follow this idea through.

In the case of a peripheral like the Koala Pad people buy one, plug it in, use the pretty picture type software to do a few scribbles on the screen, load some pictures thoughtfully provided by the manufacturers to show what can be produced and then, if they lack a certain tenacity, they put it away and never use it again. This book will stop you doing that.

Clearly, Mr Thornberg is an enthusiast and this enthusiasm is demonstrated on almost every page, beginning with a little history about Koala Pads.

Chapter Two is called "How to get the most out of the illustration software". This is the software which accompanies the Koala pad and you immediately find that there is more to this than meets the eye. The book is liberally illustrated with a very large number of pictures plus the occasional plug for some additional software and books which are available.

Chapter Three, "Getting pictures on paper", is a useful one. It emphasises that the choice of the correct or at least appropriate printer is all important in getting a decent reproduction. The Epson Series is rightly praised in this regard. There is a substantial discussion about interfacing and we even find a section on photographing the pictures on your screen – an inspired thought. Videotaping your pictures is also covered.

Chapter Four deals with other applications for the Koala Pad other than drawing pretty pictures. It turns out to be nothing more than a list of other programs available for use with the Koala Pad. These are available in the United States but not here and as such this chapter is of little value. There is a tendency for these programs to be rather expensive so their importation into the UK seems unlikely. You can of course arrange to import them yourself which is not a particularly difficult thing to do. One of the programs involved is a LOGO Design Master, and an interesting idea demonstrated is the use of an overlay card which clips on to the Koala Pad aiding handling this.

I was a little disappointed to see that COMAL was not covered since it can be used with the Koala Pad. The procedures to do this and indeed to print Koala Pad pictures have been written and are in the public domain and COMAL of course contains the entire Logo capabilities anyway.

Chapter Five is particularly interesting and is called "Replacing the Joystick, the Koala Pad alternative". This is a very down to earth and honest appraisal, I quote, "You will find that the cursor or game piece under your control will drift to the upper left hand corner of the screen when you lift your finger off the tablet, unlike joysticks Koala Pads transmit special co-ordinates to let the computer know when the finger or stylus hand is lifted. Most joystick programs interpret this lifting signal as a command to read the upper left hand corner of the screen." Well, you can't be fairer than that!

There follows a discussion on a variety of games and their performance with the Koala Pad. A number of these are available in the UK, notably *Pinball Construction Set* and *Choplifter*, plus *Droll* and *Lode Runner*.

Chapter Six is interesting, covering the use of the Koala Pad within your own programs. I think it's fair to say that if you do not use your Koala Pad within your own programs then you must have been wasting your money. This chapter shows how to use the Koala Pad with Logo, Pilot and Basic.

Chapter Seven is called "What Next", and includes some ideas for your own Koala Pad application. These include using the Pad as a game board and as a musical instrument. Many applications can benefit from the use of the Koala Pad as a custom keyboard.

Then follow appendices of references and resources. These include the suppliers of many of the programs listed. There is also a glossary of terms, which helps the novice to understand some of the jargon which is thrown about and there is a comprehensive index.

Summing up this book is difficult. It is extremely expensive so is the Koala Pad, so presumably if you can afford the one you can afford the other. It is something of a privilege to have the designer of a revolutionary piece of equipment sitting at your elbow telling you how to get the best out of it. Users of the Koala Pad will find this is a worthwhile purchase.

**B.M.**

# LISTINGS

**Listings will be much easier to enter with our new system.**

COMMODORE LISTINGS ARE RATHER well known for the horrible little black blobs that always abound. Unfortunately the graphics characters which are used to represent graphic and control characters do not reproduce very well and they are also difficult to find on the Commodore keyboard.

For this reason Your Commodore started to precede any control characters with a REM statement on the previous line that explained exactly what the black blobs were meant to be. Unfortunately the graphics characters were not documented and these still cause some confusion. For this reason we are starting to use a new method for marking the control and graphic characters in our listings.

In future all control and graphics commands will be replaced by mnemonic within square brackets. This mnemonic is not typed out as printed in the magazine but rather the corresponding key or keys on the keyboard are pressed. For example [RIGHT] means press the cursor right key, you do not type in [RIGHT]. All of the keywords, what keys to press and how they are shown on the screen are shown below.

Any character that is accessed by pressing shift and letter will be printed as [s LETTER]

| | |
|---|---|
| [s A] | shift and A |
| [s C] | shift & C |

Any character that is accessed by pressing the Commodore key and a letter will be printed as [c LETTER]

| | |
|---|---|
| [c A] | Commodore & A |
| [c C] | Commodore & C |
| [c 1] | Commodore & 1 |

Any control key will be printed out as a number. For example [001]. Control codes are accessed by pressing the CTRL and a letter at the same time [001] is CTRL & A, 002 is CTRL & B etc. See the manual for more information about control codes.

| | |
|---|---|
| [001] | CTRL & A |
| [026] | CTRL & Z |

| Mnemonic | Symbol | what to press |
|---|---|---|
| [RIGHT] | ] | left/right |
| [LEFT] | \| | shift left/right |
| [UP] | ● | Shift & up /down |
| [DOWN] | Q | up/down |
| [F1] | ▀ | f1 |
| [F2] | ╲ | shift & f1 |
| [F3] | ▄ | f3 |
| [F4] | ◥ | shift & f3 |
| [F5] | \| | f5 |
| [F6] | ╱ | shift & f5 |
| [F7] | \| | f7 |
| [F8] | L | shift & f7 |
| [CLEAR] | ♥ | shift & CLR /HOME |
| [HOME] | S | CLR/HOME |
| [RVSON] | R | CTRL & 9 |
| [RVSOFF] | ▬ | CTRL & 0 |
| [BLACK] | ┐ | CTRL & 1 |
| [WHITE] | E | CTRL & 2 |
| [RED] | £ | CTRL & 3 |
| [CYAN] | ◥ | CTRL & 4 |
| [PURPLE] | ▚ | CTRL & 5 |
| [GREEN] | ↑ | CTRL & 6 |
| [BLUE] | ← | CTRL & 7 |
| [YELLOW] | π | CTRL & 8 |

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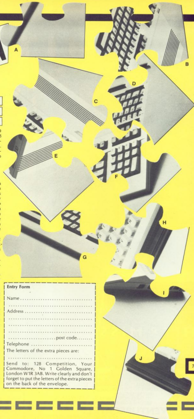

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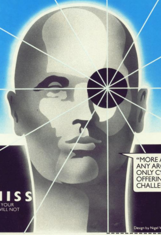

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* Note due to memory limitations ACE on the C16 and VIC20 (+8K Ram) do not have any ground objects.

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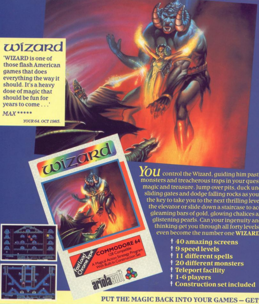
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# TOP DRAW

**This month our graphics man, Allen Webb, shows you how to get those backdrops scrolling.**

HELLO THERE, I THINK YOU'LL find this month's offering rather useful if you're into graphical adventures or platform type games.

I'm sure you've come across titles such as Monty Mole, Boulder Dash and Spelunker which use a huge backdrop for the game. The screen normally shows a small area of the backdrop and the backdrop scrolls as you move to a new play area. Got the idea? This article will provide you with the technology to perform a similar task. Whilst it doesn't use single pixel movement à la Crowther, it works well enough for most purposes.

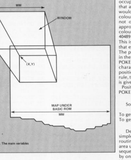

Figure 1. The main variables

So what are we doing? Consider Figure 1. The normal screen holds 1000 locations in which we can store a picture. Under the Basic ROM there are eight kilobytes of memory which can be used to hold pictures. If we also use the area between the ROMs there are 12 kilobytes of memory. The idea is to extract a portion of the picture and put it on the normal screen.

The window on the screen can be any rectangle of WW characters wide and WH characters high. The position of the square can be specified by the co-ordinates XY and YW of its top left hand corner. We also need to know which part of the map to display. The top left hand corner of the map data is specified by X and Y. The width of the map under the ROM is specified by MW. The width of the map is up to you but is limited to no more than 256 characters wide (MW=255). Here are some examples of the size of map possible using the 12K available:

| Map width | Map height |
|---|---|
| 256 | 48 |
| 80 | 150 |

From this you can see that it is possible to have up to 12 screenfuls! The selection of the map width really depends on the type of map. You will probably find it easier to design maps smaller than 80 characters wide — I will explain why later.

The package uses two commands. The first has the syntax:

```
SYS 40192,WW,WH,MW,XW,YW
```

The routine sets up the position and size of the screen window and the width of the map. This can be changed at any time without corrupting any map data. Obviously, this command must be called before any attempt is made to display the map.

The second command actually draws the map in the window and has the syntax:

```
SYS 40195,X,Y
```

This command takes a rectangle of data with top left hand co-ordinates X,Y from the map data under the ROM and puts it in the window on the screen.

Since the map data i.e. the characters put to the screen, occupy a lot of space, it follows that an equal amount of RAM would be required for the colour data. This is obviously not on and I chose another approach to the problem of colours. Starting at location 40489 is a table 255 bytes long. This is used to hold the colour that each character will adopt. The position of each character in the table is determined by its POKE value. For example, the character uses the first position 40489. As a general rule, the position of a character is given by:

Position in table = 40489 + POKE value

Some further examples are:

To get red 'A's POKE 40489+1,2
To get blue '='s POKE 40489+6

Demonstration 1 gives a simple idea of how to use the routines. Lines 20-50 fill the area under ROM with a simple sequence of characters offset by one to give diagonal stripes. Line 60 fills the colour table. Line 63000 sets up a 10 character wide, 25 character tall window, at the extreme left of the screen. The map is set to 60 columns wide. The remainder of the program allows you to scrolll the map in all directions using the cursor keys but without running off the map horizontally.

The routine is set up with the assumption that the screen is at the normal position of $0400 (1024). If you want to have the screen elsewhere, you should include the following line early in your program:

```
POKE 40265,PEEK(648):
POKE40401,216-PEEK(648)
```

This tells the routine the current page of the screen.

Listing 1

```
1 DATA76,237,157,76,22,158,0,0,0,0
,0,0,60,40,25,0,32,63,157,32,117,1
57,169
2 DATA54,133,1,162,0,160,0,177,253
,145,251,32,200,157,32,214,157,200
,204,13
3 DATA157,208,240,32,171,157,32,18
5,157,232,236,14,157,208,226,169,5
5,133
4 DATA1,96,72,152,72,138,72,169,0,
133,251,169,4,133,252,173,11,157,2
40,11
5 DATA160,0,32,171,157,200,204,11,
157,208,247,173,10,157,240,14,24,1
65,251
6 DATA109,10,157,133,251,165,252,1
05,0,133,252,104,170,104,168,104,9
6,72,152
7 DATA72,138,72,169,0,133,253,169,
160,133,254,173,8,157,240,11,160,0
,32,185
8 DATA157,200,204,8,157,208,247,17
3,6,157,240,14,24,165,253,109,6,15
7,133
9 DATA253,165,254,105,0,133,254,10
4,170,104,168,104,96,24,165,251,10
5,40,133
10 DATA251,165,252,105,0,133,252,9
6,24,165,253,109,12,157,133,253,16
5,254
11 DATA105,0,133,254,96,72,165,251
,133,170,24,165,252,105,212,133,17
1,104
12 DATA96,142,15,157,170,189,41,15
8,145,170,174,15,157,96,32,253,174
,32,138
13 DATA173,32,247,183,96,32,227,15
7,165,20,141,13,157,32,227,157,165
,20,141
14 DATA14,157,32,227,157,165,20,14
1,12,157,32,227,157,165,20,141,10,
157,32
15 DATA227,157,165,20,141,11,157,9
6,32,227,157,165,20,141,6,157,32,2
27,157
16 DATA165,20,141,8,157,76,16,157,
0,1,2,3,4,5,6,7,8,9,255
17 REM
18 FOR I=40192 TO 40499
19 READ X: T=T+X
20 POKE I,X
21 NEXT
22 POKE56,157:CLR
23 REM
24 REM***************************
25 REM*        LOADER 1          *
26 REM*                          *
27 REM* MAP PLOTTER AEW 1985     *
28 REM***************************
```

Since most of you will be using redefined characters, a relocated screen is mandatory. Listing 1 will relocate the screen to $C400 (51200) and the characters to $CB00. Lines 40-60 move the characters set down to its new position. Please note this routine takes a while to run.

Whilst this demonstration is easy, the problem is how to create a map. Clearly you have to somehow design and then put a map into the screen. The first step must be to draw the map on graph paper. This can then be converted into a form which can be stored in the machine. The obvious approach would be to use an editor which allows you to draw part of the map on screen and then transfer it to the RAM under ROM. Due to space limitations, I have not included one here. If any of you out there come up with such a program, I suggest you either submit it to this magazine or let me know since such a tool would be most useful. Demonstration 2 shows another method.

Demo 1

```
0 REM DEMO 1
1 REM
10 I=10*4096:POKE53281,0
20 J=1
30 FOR K=0TO59: POKE I+K,K+J:NEXT
40 J=J+1:IFJ=130THEN60
50 I=I+60:GOTO30
60 FORI=0TO255:POKE 40489+I,I:NEXT
63000 SYS 40192,10,25,60,0,0
63004 WW=10:SYS 40195,0,0
63005 GETI$:IFI$=""THEN63005
63010 IFI$=CHR$(29)ANDX<60-WWTHENX
=X+1
63020 IFI$=CHR$(157)ANDX>0 THENX=X
-1
63030 IFI$=CHR$(17)ANDY<130THENY=Y
+1
63040 IFI$=CHR$(145)ANDY>0THENY=Y-
1
63050 SYS40195,X,Y:GOTO63005
```

Demo 2

```
0 REM DEMO 2
1 REM
2 AD=10*4096:XM=50545
5 DATA 24,24,126,24,24,36,66,0
10 POKE 40265,PEEK(648):POKE40401,
216-PEEK(648)
20 GOSUB10000
30 POKE 40489+102,8:POKE 40489+230
,5: POKE53281,0
35 FORI=0TO7:POKE52016+I,RND(1)*25
6:NEXT
36 FORI=0TO7:POKE53040+I,RND(1)*25
6:NEXT
37 FORI=0TO7:READX:POKE52472+I,X:N
EXT
```

**Demo 2 (cont)**

```
40 FORI=0TO999:POKE50176+I,160:POK
E55296+I,9 :NEXT
50 POKE 782,0:POKE781,16:POKE783,0
:SYS65520
60 PRINT"[c 2][RVSON]THIS DEMONSTR
ATION SHOWS A SIMPLE MAZE"
70 PRINT"[RVSON]STORED BENEATH THE
 BASIC ROM."
80 PRINT:PRINT"[RVSON]A SMALL 9 BY
 WINDOW SHOWS WHERE YOU ARE."
90 PRINT"[RVSON]ASSUMING A MAP 80
COLUMNS WIDE AND USINGTHE AREA $A0
00 TO $CFFF-
"
100 PRINT"[RVSON]THE MAZE COULD CO
VER 12 SCREENS."
900 REM
910 REM MOVE MAN AROUND MAZE
920 REM
1000 SYS 40192,9,9,40,5,5
1010 WW=10:SYS 40195,0,0:POKE XM,1
59:POKE55665,1
1020 GETI$:IFI$=""THEN 1020
1030 IFI$=CHR$(29) AND X<40-WW AND
 PEEK(XM+1)=32 THENX=X+1
1040 IFI$=CHR$(157) AND X>0 AND PE
EK(XM-1)=32THENX=X-1
1050 IFI$=CHR$(17) AND Y<6 AND PEE
K(XM+40)=32THENY=Y+1
1060 IFI$=CHR$(145) AND Y>0 AND PE
EK(XM-40)=32 THENY=Y-1
1070 SYS40195,X,Y :POKEXM,159: POK
E55665,1:  GOTO1020
9900 REM
9910 REM MAZE DATA
9920 REM
10000 A$="[c +][c +][c +][c +][c +
][c +][c +][c +][c +][c +][c +][c
+][c +][c +]
[c +][c +][c +][c +][c +][c +][c +
][c +][c +][c +][c +][c +][c +][c
+][c +][c +]
[c +][c +][c +][c +][c +][c +][c +
][c +][c +][c +]":GOSUB63000
10010 A$="[c +][c +][c +][c +][c +
][c +][c +][c +][c +][c +][c +][c
+][c +][c +]
[c +][c +][c +][c +][c +][c +][c +
][c +][c +][c +][c +][c +][c +][c
+][c +][c +]
[c +][c +][c +][c +][c +][c +][c +
][c +][c +][c +]":GOSUB63000
10020 A$="[c +][c +][c +][c +][c +
][c +][c +][c +][c +][c +][c +][c
+][c +][c +]
[c +][c +][c +][c +][c +][c +][c +
][c +][c +][c +][c +][c +][c +][c
+][c +][c +]
[c +][c +][c +][c +][c +][c +][c +
][c +][c +][c +]":GOSUB63000
10030 A$="[c +][c +][c +][c +][c +
][c +][c +][c +][c +][c +][c +][c
+][c +][c +]
[c +][c +][c +][c +][c +][c +][c +
][c +][c +][c +][c +][c +][c +][c
+][c +][c +]
[c +][c +][c +][c +][c +][c +][c +
][c +][c +][c +]":GOSUB63000
10040 A$="[c +][c +][c +][c +]    [
c +][c +][c +][c +]       [c +]
  [c +][c +]
    [c +]    [c +][c +][c +][c +][
c +]":GOSUB63000
10050 A$="[c +][c +][c +][c +]
 [c +][c +]    [c +][c +][c +][c +
]   [c +][c
+][c +][c +]  [c +][c +][c +]    [
c +][c +][c +][c +][c +]":GOSUB630
00
10060 A$="[c +][c +][c +][c +] [c
+][c +][c +][c +][c +][c +]    [c +
][c +][c +][
c +][c +]   [c +][c +] [c +]  [c +
] [c +] [c +]  [c +][c +][c +][c +
][c +]":GOSU
B63000
10070 A$="[c +][c +][c +][c +]
              [c +][c +][c +]
       [c +][c
 +][c +][c +][c +]":GOSUB63000
10080 A$="[c +][c +][c +][c +] [c
+][c +][c +][c +][c +][c +][c +][c
 +][c +][c +
][c +][c +]            [c +] [c +] [c
 +][c +][c +][c +] [c +][c +][c +]
[c +][c +]":
GOSUB63000
10090 A$="[c +][c +][c +][c +] [c
+][c +][c +]     [c +][c +][c +][c
+][c +]   [c
 +][c +][c +]  [c +][c +] [c +] [c
 +][c +]   [c +][c +][c +][c +][c
+]":GOSUB630
00
10100 A$="[c +][c +][c +][c +]
         [c +][c +]  [c +][c +][c +]
[c +]  [c +]
 [c +][c +]  [c +]   [c +][c +][c
+][c +][c +]":GOSUB63000
10110 A$="[c +][c +][c +][c +][c +
][c +][c +][c +][c +][c +][c +][c
+][c +][c +]
[c +][c +][c +][c +][c +][c +][c +
][c +][c +][c +][c +][c +][c +][c
```

**Demo 2 (cont)**

```
+][c +][c +]
[c +][c +][c +][c +][c +][c +][c +
][c +][c +][c +]":GOSUB63000
10120 A$="[c +][c +][c +][c +][c +
][c +][c +][c +][c +][c +][c +][c
+][c +][c +]
[c +][c +][c +][c +][c +][c +][c +
][c +][c +][c +][c +][c +][c +][c
+][c +][c +]
[c +][c +][c +][c +][c +][c +][c +
][c +][c +][c +]":GOSUB63000
10130 A$="[c +][c +][c +][c +][c +
][c +][c +][c +][c +][c +][c +][c
+][c +][c +]
[c +][c +][c +][c +][c +][c +][c +
][c +][c +][c +][c +][c +][c +][c
+][c +][c +]
[c +][c +][c +][c +][c +][c +][c +
][c +][c +][c +]":GOSUB63000
10140 A$="[c +][c +][c +][c +][c +
][c +][c +][c +][c +][c +][c +][c
+][c +][c +]
[c +][c +][c +][c +][c +][c +][c +
][c +][c +][c +][c +][c +][c +][c
+][c +][c +]
[c +][c +][c +][c +][c +][c +][c +
][c +][c +][c +]":GOSUB63000
10150 A$="[c +][c +][c +][c +][c +
][c +][c +][c +][c +][c +][c +][c
+][c +][c +]
[c +][c +][c +][c +][c +][c +][c +
][c +][c +][c +][c +][c +][c +][c
+][c +][c +]
[c +][c +][c +][c- +][c +][c +][c +
][c +][c +][c +]":GOSUB63000
10160 RETURN
50000 REM
50010 REM CONVERT STRING TO POKE V
ALUES
50020 REM
60000 F=((I>31)AND(I<64))*1+((I>63
)AND(I<97))*64+((I>191)AND(I<224))
*128
60010 F=F+((I>159)AND(I<192))*64+(
I=255)*161
60020 IFF=-1THENC=I:RETURN
60030 C=I+F:RETURN
62900 REM
62910 REM EXTRACT MAZE FROM STRING
S AND POKE THEM INTO RAM UNDER BAS
IC ROM
62920 REM
63000 PRINTK:K=K+1:FORJ=1TO40
63010 I=ASC(MID$(A$,J,1))
63020 GOSUB60000
63025 IFC=102ANDRND(1)<.5THENC=230
63030 POKEAD,C:AD=AD+1:NEXT:RETURN
```

Since this demonstration shows an actual maze, I'll describe it line by line.

| **LINE** | |
|---|---|
| **2** | AD holds start of map, XM is position of man |
| **5** | design of man |
| **10** | screen is at $C400 |
| **20** | inputs map |
| **30** | sets maze characters to orange and green |
| **35-36** | random designs for maze characters |
| **37** | designs man |
| **40** | fills screen with brown reverse spaces |
| **50** | positions cursor |
| **60-100** | print text |
| **1000** | Sets up window by 9 by 9 at 5,5 and map to 40 characters wide |
| **1010** | WW is used to limit map scroll. Prints top left corner of map and man. |
| **1020-1070** | move map subject to position constraints. User cursor keys. |
| **10000-10160** | strings holding map design |
| **60000-60030** | convert ASC to POKE value |
| **63000-63030** | convert each line of map design to POKE values and put them under the ROM. |

If you want to use this method of entering a maze or display, you will have to convert each line of the picture on graph paper to a string. This becomes trickier as your design width gets larger than 80 characters since you will have to split the string over more than one line of Basic.

Lines 1000 to 1070 give the impression of the man moving about the maze by:

a) The man stays in the centre of the window

b) The map only scrolls if an open way exists in the direction he wishes to move

Whilst the code to do this is simple since no special logic is required to handle situations where the man approaches the maze sides, it is inefficient in its use of RAM since the maze sides must be artificially thickened. Type it in and you'll see what I mean.

To help you to save your designs, I have provided Loader 3. The syntax is:

SYS 870 "Filename",Device,2, Start Address, End Address

Where Device =1 for cassette or 8 for disk. You can use a machine code monitor to do the job but don't forget to switch the Basic ROM out before saving and back in afterwards. To load a design use the command:

LOAD "Filename",device,1

**Loader 3**

```
10 DATA32,212,225,32,253,174,32,13
8,173,32,247,183,165,20,72,165,21,
72,32,253
20 DATA174,32,138,173,32,247,183,1
65,1,41,254,133,1,166,20,164,21,10
4,133,21
30 DATA104,133,20,169,20,32,95,225
,165,1,9,1,133,1,96
40 FORI=870 TO 924 : READ X: POKE
I,X: T=T+X: NEXT
50 IF T<>5940 THEN PRINT"ERROR IN
DATA"
60 REM*********************
70 REM*        LOADER 3      *
80 REM*      BLOCK SAVE      *
90 REM*  SAVES ANY BLOCK     *
100 REM*  OF RAM BETWEEN      *
110 REM*  $0000 AND $CFFF     *
120 REM*********************

READY.

SEARCHING FOR LOADER 2LOADER
```

**Loader 2**

```
1 DATA169,0,133,163,169,160,133,16
4,160,0,169,32,145,163,24,165,163,
105,1
2 DATA133,163,165,164,105,0,133,16
4,165,163,201,255,208,233,165,164,
201,191
3 DATA208,227,96
4 REM
5 FOR I=828 TO 867
6 READ X: T=T+X
7 POKE I,X
8 NEXT
9 IF T<>5722 THEN PRINT"ERROR IN D
ATA"
10 REM*****************************
**
11 REM*           LOADER 2
 *
12 REM*  SIMPLE FILL   AEW 1985
 *
13 REM*
 *
14 REM* FILLS $A000 TO $BFFF
 *
15 REM* WITH CHARACTER IN LOCATION
 *
16 REM* 839
 *
17 REM*****************************
**
```

LOADER 2 can be used to fill the area under the ROM with a character specified in location 839. (by default space is used). The syntax is:

SYS 828

LOADER 4 may be of value if you want to look at what is in your map. This universal PEEK will return the contents of any location between $0000 and $BFFF in location 1000. The syntax is:

SYS 930,address

All of these locations use the cassette buffer and will be corrupted if cassette access is used.

**Loader 4**

```
1 DATA32,253,174,32,138,173,32,247
,183,165,20,164,21,133,180,132,181
,160,0
2 DATA169,54,133,1,177,180,141,232
,3,169,55,133,1,96
3 REM
4 FOR I=930 TO 962
5 READ X: T=T+X
6 POKE I,X
7 NEXT
8 IF T<>3964 THEN PRINT"ERROR IN D
ATA"
9 REM*************
10 REM* LOADER 4 *
11 REM* PEEKALL  *
12 REM*************
```

128

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# BUILD A BETTER BASIC

**Nick Hampshire brings you four new commands to add to your extended Basic.**

IN THE LAST TWO ARTICLES IN THIS series I have given all the initialisation and wedge routines needed to add extra commands to the Basic of a C64 computer.

Also, I have now given the code to add five new commands to Basic. These are, CTL, APPEND, CHANGE, DUMP and FIND.

This month I am adding a further four commands. They are, AUTO, CHAIN, DELETE and RENUMBER. These four commands like the four given last month are very useful 'toolkit' type commands for editing a program and are consequently all used in direct mode (except CHAIN which can be used in program mode).

All four new commands require that the wedge and initialisation code (given in the first article in this series) are present in memory at the correct locations and that their command names and entry points are stored in the correct tables. These four commands are independent of the previously added commands and can therefore be used without last month's routines. To ensure that you have the wedges and new routines correctly positioned the Basic loader at the end of this article is a repeat of last month's with the four new commands added.

The programs in this series of articles are modified extracts from the book *Advanced Commodore 64 Basic Revealed* by Nick Hampshire and published by, Collins.

## AUTO

**Abbreviated entry:** A(shift)U
**Affected Basic Abbreviation:** None
**Token:** Hex $EE,$04, Decimal 238,4
**Modes:** Direct and program
**Recommended Mode:** Direct only
**Purpose:** To save time when entering a program by providing the user with the next line number to be entered. To enable the AUTO line numbering, enter AUTO followed by the line number increment. To disable AUTO just enter AUTO without a number. The next line number is picked up from the previous line typed in, so if you enter a line 10 with the auto step at 10, the next line number would be 20. If you changed this number to, say, 100 and entered that line, the next line number displayed would be 110. A new line number is not displayed if there is nothing entered on the line.
**Syntax:** AUTO [step]
**Errors:** Syntax error — if the step value is greater than 63999 (maximum line number).
**Use:** The command is used in direct mode to enable or disable AUTO line numbering. When enabled, AUTO will produce line numbers after entering a line until it is disabled with AUTO without an increment value. If you wish to exit from the AUTO facility when a line number has been displayed, either press return (which will delete that line if it exists), or cursor down off that line.
**Routine Entry Point:** $8537
**Routine Operation:** First, this routine checks to see if there is a number following it. If not it will disable AUTO, otherwise it will read the number and store as the step and enable AUTO. The actual routine is wedged into the crunch tokens link. It first checks that the first non space character in the input buffer is a numeric character and sets a flag to say yes or no. The line is then tokenised and if there was no line number, or there was nothing following the line number, the routine exits. If the previous line typed in had a line number with something following it, the line number is read from the pointer. The step is then added to it, and the number converted to ASCII and inserted into the keyboard

## CHAIN

**Abbreviation:** CHA(shift)I
**Affected Basic Abbreviations:** None
**Token:** Hex $EE $07, Decimal 238,7
**Modes:** Direct and program
**Recommended Mode:** Either
**Purpose:** To load and run a Basic program from tape or disk. After the program has been loaded, variable pointers are set to the end of the program.
**Syntax:** As in LOAD.
**Errors:** As in LOAD.
**Use:** CHAIN is used to load and run a Basic program. It will work from another program or in direct mode having the same effect. If used from another program, it is more convenient than LOAD as LOAD does not set the variable pointers and, if the program you load is larger than the one in memory, when variables are used they will corrupt the end of the program.

**Routine Entry Point:** $8684
**Routine Operation:** The CHAIN routine simulates the LOAD routine as far as the program has been loaded. From there, variable pointers are set to the end of load, the run mode flag is set, and then three operations cause the program to run:

```
JSR $A65E ;perform CLR
JSR $A68E ;set charger pointers to the start
of program
JMP $A7AE ;execute NEXT command
```

## DELETE

**Abbreviated Entry:** DE(shift)L
**Affected Basic Abbreviations:** None
**Token:** Hex $EE,$09, Decimal 238,9
**Modes:** Direct and program
**Recommend Mode:** Direct only
**Purpose:** To delete a range of unwanted lines from a Basic program.
**Syntax:** DELETE [start line'[-[end line]] – although all parameters are denoted as optional, at least one of the parameters must be given.
**Errors:** Syntax errors – if DELETE is used without parameters.
Syntax error — if either of the line numbers is less than zero or greater than 63999.
**Use:** DELETE is used to delete a range of lines in a Basic program. These can be lines of, say, a data generating program after the DATA has been created. For example:

DELETE 100-150 — deletes lines 100 to 150 inclusive.
DELETE –1000 — deletes all lines up to line number 1000.
DELETE 2000- — deletes all lines from 2000 to the end of the program.
DELETE 0 — deletes the whole program.

Program lines that have been DELETEd cannot be recovered as they have been wiped from memory.
**Routine Entry Point:** $89AD
**Routine Operation:** DELETE first gets the range of the delete and then loops, moving the memory above the range over the top of the deleted area.

## RENUMBER

**Abbreviated Entry:** R(shift)E
**Affected Basic Abbreviations:** READ — RE(shift)A
**Token:** Hex SEE,$16, Decimal 238,22
**Modes:** Direct and program
**Recommended Mode:** Direct only
**Purpose:** To renumber a Basic program in even line number steps. All RUNs, GOTOs, GO TOs, GOSUBs, and RUNs are renumbered if found.
**Syntax:** RENUMBER start, step — where start and step are values between zero and 63999 (variables are not allowed).
**Errors:** Syntax error — if the syntax above is wrong.
Syntax error — will occur in pass one if a number following any of the commands mentioned in 'Purpose' are 0 or 63999.
Undefined xxxxx in old line yyyyy — if a line does not exist.
Syntax Error – will occur to pass two if the new line number is greater than 63999.
**Use:** RENUMBER is useful for opening up program lines for the insertion of more lines or just making the program tidy after it is finished. All commands that contain line numbers will be changed so that the new line number is inserted:

RUN xxxxx
GOTO xxxxx
GO TO xxxxx
GOSUB xxxxx
THEN xxxxx
ON exp GOTOxxxxx,xxxxx.....
On exp GOSUBxxxxx,xxxxx.....

**Routine Entry Point:** $9A5D
**Routine Operation:** The start and step are read in and syntax error is output if they are out of range. Pass one is displayed and performed. At each occurrence of a branch as above the routine will print a '.' character. If the line does not exist, the error message 'undefined xxxxx in old line yyyyy' will be displayed and replaced with the number 65535 (illegal). This is done throughout the program until the end is found. Then pass two is displayed and the line numbers are changed to the new values.
**Note:** If syntax error is encountered in either of the passes, the renumber process will be stopped but the program will be partly renumbered and thus will not run.

**CHAIN LISTING**

```
1000 CHAIN JSR $E1D4 ;GET NAME
1010  LDA #$00
1020  STA $B9 ;SECONDARY ADDRESS=0
1030  LDX $2B
1040  LDY $2C ;ADDRESS TO LOAD AT
1050  JSR $FFD5 ;LOAD IT
1060  BCS CHAIN1 ;LOAD WAS NOT O.K.
1070  STX $2D ;SAVE END OF LOAD
1080  STX $2F ; ADDRESS IN VARIABLE
1090  STX $31 ; POINTERS
1100  STY $2E
1110  STY $30
1120  STY $32
1130  LDA #$0D ;PRINT CR
1140  JSR $FFD2
1150  LDA #$00 ;SET TO RUN
1160  STA $9D
1170  STA REPESK ;CLEAR REPEAT STACK
1180  JSR $A65E ;CLR
1190  JSR $A68E ;SET CHARGET POINTER
1200  JMP $A7AE ;RUN
1210 CHAIN1 JMP $E0F9 ;SEND ERROR MESS
AGE
1220 REPESK .BYT 0
1230 .END
```

**AUTO LISTING**

```
1000 AUTONO BEQ AUTOFF ; NO STEP, TURN
 OFF
1010  JSR $A96B ; GET STEP
1020  LDA $14 ; STORE AWAY
1030  STA AUTOST
1040  LDA $15
1050  STA AUTOST+1
1060  LDA #<AUTO ; ENABLE AUTO
1070  STA $0304
1080  LDA #>AUTO
1090  STA $0305
1100  RTS
1110 ;
1120 AUTOFF LDA #<CRNCHT ; DISABLE AUT
O
1130  STA $0304
1140  LDA #>CRNCHT
1150  STA $0305
1160  RTS
1170 AUTOST .WOR 0
1180 ;
1190 AUTO LDA $0200 ; CHECK FIRST CHAR
ACTER
1200  CMP #$30 ; IN INPUT BUFFER FOR
1210  BCC AUTO01 ; A NUMBER
1220  CMP #$3A
1230  BCS AUTO01
1240  LDA #$01 ; SET FLAG TO SAY
1250  STA $02 ; DO IT
1260  BNE AUTO02
1270 AUTO01 LDA #$00 ; SET FLAG TO SAY
1280  STA $02 ; DON'T DO IT
1290 AUTO02 JSR CRNCHT ; CRUNCH INPUT
1300  LDA $02 ; CHECK FLAG
1310  BNE AUTO03
1320  RTS ; DON'T DO IT
1330 AUTO03 CPY #$05 ; CHECK FOR BLANK
1340  BNE AUTO04 ; INPUT LINE
1350  RTS
1360 AUTO04 LDA AUTOST ; ADD STEP TO P
REVIOUS
1370  CLC ; LINE NUMBER
1380  ADC $14
1390  TAX
1400  LDA AUTOST+1
1410  ADC $15
1420  STX $63
1430  STA $62
1440  LDX #$90
1450  SEC
1460  TYA
1470  PHA
1480  JSR $BC49 ; CONVERT LINE NUMBER
1490  JSR $BDDF ; TO ASCII STRING
1500  STA $FB
1510  STY $FC
1520  LDY #$00
1530 AUTO05 LDA ($FB),Y ; COPY ASCII
1540  BEQ AUTO06 ; STRING INTO KYBD
1550  STA $0277,Y ; BUFFER
1560  INY
1570  BNE AUTO05
1580 AUTO06 INY
1590  LDA #$20 ; AND A SPACE
1600  STA $0277,Y
1610  STY $C6 ; NUMBER OF CHARS IN
1620  PLA ; BUFFER
1630  TAY
1640  RTS
1650 .END
```

**RENUMBER LISTING**

```
1000 RENUMB JSR $A96B ;GET START
1010  LDA $14 ;LSB
1020  STA RENSRT ;STORE IT
1030  LDA $15 ;MSB
1040  STA RENSRT+1 ;STORE IT
1050  JSR $AEFD ;SCAN ','
1060  JSR $A96B ;GET STEP
1070  LDA $14 ;LSB
1080  STA RENSTP ;STORE IT
1090  LDA $15 ;MSB
1100  STA RENSTP+1 ;STORE IT
1110  JSR $A68E ;SET CHARGET POINTER
1120  JSR RENMS1 ;SEND PASS1 MESSAGE
1130  JMP RENPS1 ;PASS 1
1140 RENU01 JSR $A68E ;SET CHARGET POI
NTER
1150  JSR RENMS2 ;SEND PASS2 MESSAGE
1160  JMP RENPS2 ;DO PASS 2 AND END
1170 ;
```

```
1180 ;TELL USER WHAT WE ARE DOING
1190 ;
1200 RENMS1 LDA #<PS1MES ;POINT TO
1210  LDY #>PS1MES ;MESSAGE
1220  BNE RENMS3 ;SEND IT
1230 RENMS2 LDA #<PS2MES ;POINT TO
1240  LDY #>PS2MES ;MESSAGE
1250 RENMS3 JMP $AB1E ;OUTPUT MESSAGE
1260 ;
1270 PS1MES .BYT '#### PASS 1 ####',$0
D,$00
1280 PS2MES .BYT $0D,'#### PASS 2 ####
',$0D,$00
1290 RENILL .BYT $0D,'UNDEFINED ',$00
1300 RENIL1 .BYT ' IN OLD LINE ',$00
1310 ;
1320 ;VARIABLES USED
1330 ;
1340 RENSRT .WOR 0 ;START OF RENUMBER
1350 RENSTP .WOR 0 ;RENUMBER STEP
1360 RENLNK .WOR 0 ;POINTER:START OF #
1370 RENLNO .WOR 0 ;POINTER:START OF L
INE
1380 RENUST .WOR 0 ;WARM START STORE
1390 RENLEN .BYT 0 ;LENGTH:JUMP #
1400 RENLN1 .BYT 0
1410 RENTBL .BYT $00 ;DUMMY
1420  .BYT $89 ;GOTO
1430  .BYT $8A ;RUN
1440  .BYT $8D ;GOSUB
1450  .BYT $A7 ;THEN
1460 RUNT =1 ;TOKEN VALUE OF MY RUN
1470 ;
1480 ;PASS 2
1490 ;
1500 RENPS2 JSR RENU02 ;GET NEXT BYTE
1510 RENPS3 LDY #$00
1520  LDA ($7A),Y ;GET BYTE
1530  STA RENLNK ;NEXT LINE LO
1540  INY
1550  LDA ($7A),Y ;GET BYTE
1560  STA RENLNK+1 ;NEXT LINE HI
1570  LDA RENSRT ;GET LINE NUMBER LO
1580  INY
1590  STA ($7A),Y ;STORE IT
1600  LDA RENSRT+1 ;HI
1610  INY
1620  STA ($7A),Y ;STORE IT
1630  CLC
1640  LDA RENSRT ;GET LINE# LO
1650  ADC RENSTP ;ADD STEP
1660  STA RENSRT ;STORE IT
1670  LDA RENSRT+1 ;HI
1680  ADC RENSTP+1 ;ADD STEP
1690  STA RENSRT+1 ;STORE IT
1700  LDA RENLNK+1 ;GET LINK HI
1710  BEQ RENUXT ;ZERO, END OF PROG
1720  STA $7B
1730  LDA RENLNK ;GET LO
1740  STA $7A
1750  JMP RENPS3 ;AND AGAIN
1760 RENUXT JMP $A474 ;BACK TO 'READY'
1770 ;
1780 ;SUBROUTINE TO GET NEXT CHAR
1790 ; WITHOUT SCANNING PAST SPACES
1800 ;
1810 RENU02 INC $7A ;BUMP LO
1820  BNE RENU03
1830  INC $7B ;BUMP HI
1840 RENU03 LDY #$00 ;SET INDEX
1850  LDA ($7A),Y ;GET BYTE
1860  RTS
1870 ;
1880 ;PASS 1
1890 ;
1900 RENPS1 JSR RENU02 ;GET BYTE
1910  JSR RENU02 ;GET BYTE
1920  BNE RENP01 ;NOT END OF PROG
1930  JMP RENU01 ;END OF PROGRAM
1940 RENP01 LDA $7A ;GET POINTER LO
1950  STA RENLNO ;STORE IT
1960  LDA $7B ;HI
1970  STA RENLNO+1 ;STORE IT
1980  JSR RENU02 ;GET BYTE
1990  JSR RENU02 ;GET BYTE
2000 RENP02 JSR RENU02 ;GET BYTE
2010 RENP12 CMP #$00 ;END OF LINE?
2020  BEQ RENPS1 ;YES
2030  CMP #$EE ;MY TOKEN?
2040  BEQ RENP05 ;YES
2050  CMP #$22 ;QUOTES?
2060  BEQ RENP04
2070  TAX
2080  BPL RENP02 ;NOT A TOKEN
2090  LDX #$04 ;LOOP TEST TOKENS
2100 RENP03 CMP RENTBL,X ;CHANGE IT?
2110  BEQ RENP06 ;YES
2120  DEX
2130  BNE RENP03 ;DO NEXT
2140  CMP #$CB ;IS IT 'GO'?
2150  BNE RENP02 ;NO
2160  JSR $0073 ;NEXT CHARACTER
2170  CMP #$A4 ;IS IT 'TO'?
2180  BNE RENP12 ;NO
2190  BEQ RENP06 ;YES
2200 RENP04 JSR RENU02 ;GET BYTE
2210  BEQ RENPS1 ;END OF LINE
2220  CMP #$22 ;IS IT QUOTES?
2230  BEQ RENP02 ;YES, DO NEXT
2240  BNE RENP04 ;ALWAYS
2250 RENP05 JSR RENU02 ;GET BYTE
2260  CMP #RUNT ;RUN TOKEN?
2270  BNE RENP02 ;NO
2280 ;
2290 ;ONE OF THE FIVE TOKENS HAS BEEN
2300 ; FOUND.
2310 ;
2320 RENP06 LDA #'. ;TELL USER DOING
2330  JSR $FFD2 ;PRINT IT
2340  JSR $0073 ;GET NEXT CHAR
2350  BCC RENP56 ;IS A NUMBER
2360  JMP RENU04 ;CHECK FOR ','
2370 RENP56 LDA $7A ;GET POINTER LO
2380  STA RENLNK ;STORE IT
2390  LDA $7B ;HI
2400  STA RENLNK+1 ;STORE IT
2410  LDY #$00
2420 RENP07 LDA ($7A),Y ;GET BYTE
2430  INY
2440  CMP #$30 ;LESS THAN '0'?
2450  BCC RENP08 ;YES
2460  CMP #$3A ;NUMERIC?
2470  BCC RENP07 ;YES
2480 RENP08 DEY
2490  DEY
2500  STY RENLEN ;STORE LENGTH
2510  LDA $7A
2520  BNE RENU05
2530  DEC $7B
2540 RENU05 DEC $7A
2550  JSR $0073 ;GET CHARACTER
2560  JSR $A96B ;GET LINE NUMBER
2570  JSR RENP18 ;CALCULATE NEW NUMBER
2580  LDA RENLNO ;RESTORE START OF LIN
E
2590  STA $7A ;LO
2600  LDA RENLNO+1
2610  STA $7B ;HI
2620  JSR RENU02 ;GET LINE# LO
2630  STA $14 ;STORE IT
2640  JSR RENU02 ;HI
2650  STA $15 ;STORE IT
2660  LDX #$00
2670 RENP10 JSR RENU02 ;GET BYTE
2680  PHA
2690  LDA $7A ;REACHED NUMBER?
2700  CMP RENLNK
2710  BNE RENP50 ;NOT YET
2720  LDA $7B
2730  CMP RENLNK+1
2740  BEQ RENP51 ;YES
2750 RENP50 PLA
2760  STA $0200,X ;STORE BYTE
2770  INX
2780  BNE RENP10 ;ALWAYS
2790 RENP51 PLA
2800  LDY #$00
2810 RENP11 LDA $0100,Y ;GET NEW LINE#
2820  BEQ RENP13 ;END OF STRING
2830  STA $0200,X ;STORE IT
2840  INY
2850  INX
2860  BNE RENP11 ;ALWAYS
2870 RENP13 STY RENLN1
2880  LDA RENLEN ;GET LENGTH
2890  CLC
2900  ADC $7A ;ADD TO POINTER
```

```
2910  STA $7A ;STORE IT
2920  LDA $7B ;HI
2930  ADC #$00
2940  STA $7B
2950 RENP14 JSR RENU02 ;GET BYTE
2960  STA $0200,X ;STORE IT
2970  BEQ RENP15 ;END OF LINE
2980  INX
2990  BNE RENP14 ;ALWAYS
3000 RENP15 TXA
3010  CLC
3020  ADC #$05 ;INCREASE BUFFER POINTE
R
3030  STA $0B ;AND STORE IT
3040  LDA $0302 ;GET WARM START LO
3050  STA RENUST ;STORE IT
3060  LDA $0303 ;HI
3070  STA RENUST+1 ;STORE IT
3080  LDA #<RENP16 ;SET WARM START
3090  STA $0302 ; VECTOR TO RETURN
3100  LDA #>RENP16 ; TO PROGRAM
3110  STA $0303 ; AFTER MAKING CHANGE
3120  LDY $0B ;GET BUFFER POINTER
3130  JMP $A4A4 ;CHANGE LINE
3140 RENP16 LDA RENUST ;RESTORE WARM
3150  STA $0302 ;START VECTOR
3160  LDA RENUST+1
3170  STA $0303
3180  DEC RENLN1
3190  LDA RENLN1 ;MOVE TO END OF
3200  CLC ;NEW LINE#
3210  ADC RENLNK
3220  STA $7A
3230  LDA RENLNK+1
3240  ADC #$00
3250  STA $7B
3260  JSR $0073 ;GET NEXT CHAR
3270 RENU04 CMP #', ;IS IT A COMMA?
3280  BEQ RENP17 ;YES
3290  JMP RENP12 ;TRY NEXT CHAR
3300 RENP17 JMP RENP06 ;DO NEXT LINE#
3310 ;
3320 ;CALCULATE NEW LINE NUMBER
3330 ;
3340 RENP18 JSR $A68E ;SET CHARGET POI
NTER
3350  LDA RENSRT ;SET LINE NUMBER
3360  STA $63
3370  LDA RENSRT+1
3380  STA $62
3390 RENP19 JSR RENU02 ;GET BYTE
3400  JSR RENU02 ;GET BYTE
3410  BNE RENP20 ;NOT END OF PROG
3420  LDA #$9D
3430  JSR $FFD2
3440  LDA #$20 ;FLAG ERROR
3450  JSR $FFD2
3460  LDA #<RENILL
3470  LDY #>RENILL
3480  JSR $AB1E :PRINT
3490  LDA $15
3500  LDX $14
3510  JSR $BDCD ;PRINT NUMBER
3520  LDA #<RENIL1
3530  LDY #>RENIL1
3540  JSR $AB1E ;PRINT
3550  LDA RENLNO
3560  STA $FB
3570  LDA RENLNO+1
3580  STA $FC
3590  LDY #$01
3600  LDA ($FB),Y
3610  TAX
3620  INY
3630  LDA ($FB),Y
3640  JSR $BDCD ;PRINT LINE NUMBER
3650  LDA #$0D ;CARRIAGE RETURN
3660  JSR $FFD2 ;PRINT IT
3670  LDA #$FF ;ILLEGAL LINE NUMBER
3680  STA $63 ;65535
3690  STA $62
3700  BMI RENP21 ;ALWAYS
3710 RENP20 JSR RENU02 ;GET BYTE
3720  CMP $14 ;SAME AS LINE#?
3730  BNE RENP22 ;NO
3740  JSR RENU02 ;GET BYTE
3750  CMP $15
3760  BNE RENP23 ;NO
3770 RENP21 LDX #$90
3780  SEC
3790  JSR $BC49 ;CONVERT LINE
3800  JMP $BDDF ;NUMBER TO ASCII
3810 RENP22 JSR RENU02 ;GET BYTE
3820 RENP23 LDA $63 ;BUMP NEW LINE
3830  CLC ;NUMBER BY
3840  ADC RENSTP ;STEP
3850  STA $63
3860  LDA $62
3870  ADC RENSTP+1
3880  STA $62
3890 RENP24 JSR RENU02 ;GET BYTE
3900  BNE RENP24 ;NOT END OF LINE
3910  BEQ RENP19 ;ALWAYS
3920 .END
```

## BASIC LOADER LISTING

```
100 REM ################################
110 REM #LOADER FOR BASIC EXTENSION #
120 REM #PACKAGE.                   #
130 REM #INCLUDES WEDGES AND THE    #
140 REM #COMMANDS:                  #
150 REM #APPEND,CHANGE,CTL,DUMP,AUTO#
160 REM #FIND,CHAIN,DELETE,RENUMBER #
170 REM #COPYRIGHT 20.8.85          #
180 REM #NICK HAMPSHIRE             #
190 REM ################################
200 I=1:X=0:L=32768
210 READA:IFA=999THEN300
220 POKEL,A
230 L=L+1:I=I+1:X=X+A
240 GOTO210
300 IFI<>3928THENPRINT"NUMBER OF DATA
ENTRIES ERROR "I" SHOULD BE 3928":END
310 IFX<>461695 THENPRINT"CHECKSUM ERR
OR. VALUE "X" SHOULD BE 461695":END
320 REM TO RUN ROUTINES SYS(64738)
330 REM
340 END
1000 DATA122,128,57,128,195,194,205
1010 DATA56,48,139,227,131,164,201
1020 DATA129,158,130,247,130,59,131
1030 DATA76,72,178,0,49,234,68
1040 DATA128,71,254,74,243,145,242
1050 DATA14,242,80,242,51,243,241
1060 DATA131,202,241,237,246,62,241
1070 DATA47,243,68,128,165,244,237
1080 DATA245,32,188,246,32,225,255
1090 DATA240,3,76,114,254,32,163
1100 DATA253,32,24,229,32,93,128
1110 DATA32,204,255,169,0,133,19
1120 DATA32,122,166,88,162,128,76
1130 DATA136,227,162,21,160,128,134
1140 DATA195,132,196,160,35,177,195
1150 DATA153,16,3,136,16,248,169
1160 DATA118,160,131,141,143,2,140
1170 DATA144,2,96,142,22,208,32
1180 DATA163,253,32,80,253,32,91
1190 DATA255,32,93,128,88,32,229
1200 DATA128,32,191,227,169,128,133
1210 DATA52,133,54,133,56,169,0
1220 DATA133,51,133,53,133,55,169
1230 DATA172,160,128,32,45,228,162
1240 DATA251,154,208,172,147,13,32
1250 DATA32,32,32,42,42,42,42
1260 DATA32,69,88,84,69,78,68
1270 DATA69,68,32,54,52,32,66
1280 DATA65,83,73,67,32,86,48
1290 DATA49,32,42,42,42,42,13
1300 DATA13,32,54,52,75,32,82
1310 DATA65,77,32,83,89,83,84
1320 DATA69,77,32,32,0,162,11
1330 DATA189,9,128,157,0,3,202
1340 DATA16,247,96,82,85,206,67
1350 DATA84,204,65,80,80,69,78
1360 DATA196,65,85,84,207,67,65
1370 DATA84,65,76,79,199,67,72
1380 DATA65,78,71,197,67,72,65
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1390 DATA73,206,67,82,85,78,67
1400 DATA200,68,69,76,69,84,197
1410 DATA68,73,83,203,68,79,75
1420 DATA197,68,85,77,208,69,88
1430 DATA69,195,70,73,78,196,71
1440 DATA69,212,75,69,217,77,65
1450 DATA212,77,69,82,71,197,79
1460 DATA76,196,80,79,208,80,85
1470 DATA212,82,69,78,85,77,66
1480 DATA69,210,82,69,80,69,65
1490 DATA212,83,79,82,212,84,82
1500 DATA65,67,69,79,206,84,82
1510 DATA65,67,69,79,70,198,84
1520 DATA89,80,197,85,78,84,73
1530 DATA204,68,69,69,203,72,73
1540 DATA77,69,205,76,79,77,69
1550 DATA205,86,65,82,80,84,210
1560 DATA0,13,143,138,133,197,138
1570 DATA36,139,16,143,116,134,163
1580 DATA139,19,143,216,139,22,143
1590 DATA25,143,187,135,28,143,135
1600 DATA137,31,143,34,143,37,143
1610 DATA40,143,43,143,46,143,49
1620 DATA143,120,140,52,143,55,143
1630 DATA58,143,61,143,64,143,67
1640 DATA143,70,143,73,143,76,143
1650 DATA79,143,166,122,160,4,132
1660 DATA15,189,0,2,16,7,201
1670 DATA255,240,43,232,208,244,201
1680 DATA32,240,36,133,8,201,34
1690 DATA240,71,36,15,112,26,201
1700 DATA63,208,4,169,153,208,18
1710 DATA201,48,144,4,201,60,144
1720 DATA10,76,70,130,169,238,44
1730 DATA5,11,164,113,232,200,153
1740 DATA251,1,201,238,240,49,185
1750 DATA251,1,240,34,56,233,58
1760 DATA240,4,201,73,208,2,133
1770 DATA15,56,233,85,208,174,133
1780 DATA8,189,0,2,240,219,197
1790 DATA8,240,215,200,153,251,1
1800 DATA232,208,240,153,253,1,198
1810 DATA123,169,255,133,122,96,165
1820 DATA11,200,153,251,1,76,207
1830 DATA129,132,113,160,255,134,122
1840 DATA202,169,1,133,11,200,232
1850 DATA189,0,2,56,249,241,128
1860 DATA240,245,201,128,240,156,166
1870 DATA122,230,11,200,185,240,128
1880 DATA16,250,185,241,128,208,228
1890 DATA160,0,132,11,136,166,122
1900 DATA202,200,232,189,0,2,56
1910 DATA249,158,160,240,245,201,128
1920 DATA208,3,76,255,129,166,122
1930 DATA230,11,200,185,157,160,16
1940 DATA250,185,158,160,208,225,189
1950 DATA0,2,76,1,130,48,3
1960 DATA76,243,166,201,255,240,249
1970 DATA36,15,48,245,201,238,240
1980 DATA5,32,217,130,48,3,32
1990 DATA186,130,76,239,166,200,177
2000 DATA95,170,132,73,160,255,202
2010 DATA240,8,200,185,241,128,16
2020 DATA250,48,245,200,185,241,128
2030 DATA48,5,32,210,255,208,245
2040 DATA96,56,233,127,170,132,73
2050 DATA160,255,202,240,8,200,185
2060 DATA158,160,16,250,48,245,200
2070 DATA185,158,160,48,230,32,210
2080 DATA255,208,245,32,115,0,201
2090 DATA238,240,10,201,153,240,38
2100 DATA32,121,0,76,231,167,32
2110 DATA14,131,76,174,167,230,122
2120 DATA208,2,230,123,160,0,177
2130 DATA122,56,233,1,10,168,185
2140 DATA138,129,72,185,137,129,72
2150 DATA76,115,0,32,46,131,76
2160 DATA174,167,173,58,131,72,173
2170 DATA57,131,72,76,115,0,235
2180 DATA132,169,0,133,13,32,115
2190 DATA0,201,238,240,6,32,121
2200 DATA0,76,141,174,230,122,208
2210 DATA2,230,123,160,0,177,122
2220 DATA201,29,176,3,76,8,175
2230 DATA133,36,169,173,72,169,140
2240 DATA72,198,36,165,36,10,170
2250 DATA189,138,129,72,189,137,129
2260 DATA72,76,115,0,165,157,240
2270 DATA16,169,1,36,212,208,10
2280 DATA165,203,201,3,144,4,201
2290 DATA7,144,3,76,72,235,197
2300 DATA197,240,249,169,0,133,252
2310 DATA133,251,169,1,44,141,2
2320 DATA240,4,169,32,133,251,169
2330 DATA191,133,252,169,192,24,101
2340 DATA251,133,251,165,203,201,3
2350 DATA208,4,169,24,208,18,201
2360 DATA6,208,4,169,16,208,10
2370 DATA201,5,208,4,169,8,208
2380 DATA2,169,0,24,101,251,133
2390 DATA251,160,0,169,54,133,1
2400 DATA177,251,240,8,153,119,2
2410 DATA200,192,8,208,244,132,198
2420 DATA169,55,133,1,165,203,133
2430 DATA197,173,141,2,141,142,2
2440 DATA96,165,153,208,4,165,157
2450 DATA208,3,76,87,241,165,211
2460 DATA133,202,165,214,133,201,152
2470 DATA72,138,72,165,208,240,6
2480 DATA76,58,230,32,22,231,165
2490 DATA198,133,204,141,146,2,240
2500 DATA247,120,165,207,240,12,165
2510 DATA206,174,135,2,160,0,132
2520 DATA207,32,19,234,32,180,229
2530 DATA201,131,208,16,162,9,120
2540 DATA134,198,189,230,236,157,118
2550 DATA2,202,208,247,240,207,201
2560 DATA13,208,3,76,2,230,201
2570 DATA17,208,193,166,214,224,24
2580 DATA240,3,76,15,132,162,24
2590 DATA160,0,24,32,240,255,230
2600 DATA20,208,2,230,21,32,19
2610 DATA166,160,1,177,95,208,16
2620 DATA169,255,133,20,133,21,169
2630 DATA185,160,132,32,30,171,76
2640 DATA18,132,160,2,177,95,133
2650 DATA20,200,177,95,133,21,169
2660 DATA162,141,0,3,169,132,141
2670 DATA1,3,104,141,183,132,104
2680 DATA141,184,132,160,1,132,15
2690 DATA76,215,166,169,139,141,0
2700 DATA3,169,227,141,1,3,173
2710 DATA184,132,72,173,183,132,72
2720 DATA76,18,132,0,10,13,13
2730 DATA18,42,42,42,42,42,42
2740 DATA42,42,42,42,42,42,32
2750 DATA69,78,68,32,79,70,32
2760 DATA80,82,79,71,82,65,77
2770 DATA32,42,42,42,42,42,42
2780 DATA42,42,42,42,42,42,13
2790 DATA0,32,33,171,32,121,0
2800 DATA240,80,240,94,201,163,240
2810 DATA107,201,166,24,240,102,201
2820 DATA238,208,20,160,1,177,122
2830 DATA201,2,208,12,32,115,0
2840 DATA32,115,0,32,139,133,76
2850 DATA233,132,32,121,0,201,44
2860 DATA240,55,201,59,240,97,32
2870 DATA158,173,36,13,48,195,32
2880 DATA221,189,32,135,180,32,33
2890 DATA171,32,59,171,208,184,169
2900 DATA0,157,0,2,162,255,160
2910 DATA1,165,19,208,16,169,13
2920 DATA32,71,171,36,19,16,5
2930 DATA169,10,32,71,171,73,255
2940 DATA96,56,32,240,255,152,56
2950 DATA233,10,176,252,73,255,105
2960 DATA1,208,25,8,56,32,240
2970 DATA255,132,9,32,155,183,201
2980 DATA41,240,3,76,8,175,40
2990 DATA144,6,138,229,9,144,5
3000 DATA170,232,202,208,6,32,115
3010 DATA0,76,238,132,32,59,171
3020 DATA208,242,76,30,171,32,12
3030 DATA134,32,250,174,32,121,0
3040 DATA32,49,134,176,8,32,69
3050 DATA134,142,111,134,176,66,32
3060 DATA46,134,176,8,32,78,134
3070 DATA142,112,134,176,53,32,46
3080 DATA134,176,8,32,72,134,142
3090 DATA113,134,176,40,32,46,134
3100 DATA176,8,32,72,134,142,114
3110 DATA134,176,27,32,46,134,176
3120 DATA8,32,72,134,142,115,134
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3130 DATA176,14,32,46,134,144,3
3140 DATA76,8,175,32,75,134,142
3150 DATA116,134,32,247,174,173,116
3160 DATA134,240,5,169,147,32,22
3170 DATA231,173,113,134,141,134,2
3180 DATA173,114,134,141,33,208,173
3190 DATA115,134,141,32,208,172,111
3200 DATA134,174,112,134,24,76,240
3210 DATA255,56,32,240,255,140,111
3220 DATA134,142,112,134,173,33,208
3230 DATA141,114,134,173,32,208,141
3240 DATA115,134,173,134,2,141,113
3250 DATA134,169,0,141,116,134,96
3260 DATA32,115,0,201,44,208,2
3270 DATA56,96,201,41,240,2,24
3280 DATA96,104,104,32,115,0,76
3290 DATA230,133,169,40,44,169,16
3300 DATA44,169,2,44,169,25,141
3310 DATA110,134,32,158,183,236,110
3320 DATA134,176,14,32,121,0,201
3330 DATA41,240,211,201,44,240,213
3340 DATA76,8,175,162,14,76,55
3350 DATA164,0,0,0,0,0,0
3360 DATA0,32,225,138,32,134,138
3370 DATA133,89,162,0,32,188,137
3380 DATA162,0,32,223,134,134,252
3390 DATA32,218,137,120,173,0,3
3400 DATA141,196,138,173,1,3,141
3410 DATA197,138,169,92,141,0,3
3420 DATA169,138,141,1,3,88,32
3430 DATA232,137,76,179,134,32,93
3440 DATA138,32,238,137,76,167,134
3450 DATA165,252,56,229,34,240,3
3460 DATA76,5,135,164,35,162,64
3470 DATA165,1,41,254,133,1,189
3480 DATA64,191,240,7,145,87,232
3490 DATA200,76,199,134,165,1,9
3500 DATA1,133,1,136,132,35,76
3510 DATA170,134,32,128,138,197,89
3520 DATA240,3,76,8,175,32,128
3530 DATA138,240,17,197,89,240,13
3540 DATA157,128,191,232,224,64,208
3550 DATA239,162,23,76,55,164,169
3560 DATA0,157,128,191,96,160,0
3570 DATA177,87,133,20,200,177,87
3580 DATA133,21,162,0,200,196,35
3590 DATA240,10,177,87,157,0,2
3600 DATA232,224,86,208,241,165,1
3610 DATA41,254,133,1,160,0,185
3620 DATA128,191,240,9,157,0,2
3630 DATA232,200,224,87,208,242,165
3640 DATA1,9,1,133,1,165,35
3650 DATA24,101,34,168,165,35,24
3660 DATA101,252,133,35,198,35,177
3670 DATA87,157,0,2,200,232,201
3680 DATA0,240,10,224,88,208,241
3690 DATA169,0,157,0,2,232,142
3700 DATA185,135,138,24,105,4,133
3710 DATA11,173,2,3,141,186,135
3720 DATA173,3,3,141,187,135,169
3730 DATA136,141,2,3,169,135,141
3740 DATA3,3,32,139,138,164,11
3750 DATA76,164,164,173,186,135,141
3760 DATA2,3,173,187,135,141,3
3770 DATA3,32,165,138,165,87,197
3780 DATA45,208,6,165,88,197,46
3790 DATA240,19,173,185,135,201,1
3800 DATA240,3,76,170,134,160,2
3810 DATA132,35,162,0,76,173,134
3820 DATA76,75,138,0,0,0,165
3830 DATA46,133,96,165,45,133,95
3840 DATA56,229,47,165,96,229,48
3850 DATA144,3,76,167,136,32,127
3860 DATA136,165,37,240,43,201,1
3870 DATA240,71,201,2,240,92,169
3880 DATA37,32,210,255,32,157,136
3890 DATA169,61,32,210,255,160,2
3900 DATA177,95,72,200,177,95,168
3910 DATA104,32,145,179,32,221,189
3920 DATA32,30,171,76,99,136,169
3930 DATA32,32,210,255,32,157,136
3940 DATA169,61,32,210,255,32,133
3950 DATA177,165,71,164,72,32,162
3960 DATA187,32,221,189,32,218,189
3970 DATA76,99,136,32,157,136,169
3980 DATA47,160,136,32,30,171,76
3990 DATA99,136,32,61,32,70,85
4000 DATA78,67,84,73,79,78,0
4010 DATA162,3,189,132,137,32,210
4020 DATA255,224,3,208,3,32,157
4030 DATA136,202,16,240,160,4,177
4040 DATA95,133,35,136,177,95,133
4050 DATA34,136,177,95,32,36,171
4060 DATA169,34,32,210,255,169,13
4070 DATA32,210,255,32,225,255,208
4080 DATA1,96,24,165,95,105,7
4090 DATA133,95,166,96,144,1,232
4100 DATA134,96,76,196,135,160,0
4110 DATA132,37,200,177,95,10,38
4120 DATA37,74,153,69,0,136,16
4130 DATA244,165,69,32,210,255,165
4140 DATA70,240,3,32,210,255,96
4150 DATA165,70,208,5,169,32,32
4160 DATA210,255,96,169,13,32,210
4170 DATA255,165,47,133,95,165,48
4180 DATA133,96,165,96,197,50,208
4190 DATA6,165,95,197,49,240,173
4200 DATA32,225,255,240,168,32,127
4210 DATA136,165,37,240,10,201,2
4220 DATA208,3,169,36,44,169,37
4230 DATA44,169,32,32,210,255,32
4240 DATA157,136,169,32,32,210,255
4250 DATA169,40,32,210,255,165,95
4260 DATA24,105,3,133,251,165,96
4270 DATA105,0,133,252,160,1,177
4280 DATA251,133,253,169,0,133,254
4290 DATA6,253,38,254,165,253,24
4300 DATA101,251,133,253,165,254,101
4310 DATA252,133,254,160,0,177,253
4320 DATA141,131,137,200,177,253,141
4330 DATA130,137,208,3,206,131,137
4340 DATA206,130,137,173,131,137,174
4350 DATA130,137,164,95,140,130,137
4360 DATA164,96,140,131,137,32,205
4370 DATA189,172,130,137,132,95,172
4380 DATA131,137,132,96,56,165,253
4390 DATA233,2,133,253,165,254,233
4400 DATA0,133,254,197,252,208,6
4410 DATA165,253,197,251,240,8,169
4420 DATA44,32,210,255,76,16,137
4430 DATA160,3,177,95,133,251,136
4440 DATA177,95,24,101,95,133,95
4450 DATA165,96,101,251,133,96,169
4460 DATA41,32,210,255,169,13,32
4470 DATA210,255,76,180,136,0,0
4480 DATA34,32,61,36,32,134,138
4490 DATA133,89,162,0,32,188,137
4500 DATA32,218,137,120,173,0,3
4510 DATA141,196,138,173,1,3,141
4520 DATA197,138,169,92,141,0,3
4530 DATA169,138,141,1,3,88,32
4540 DATA232,137,32,93,138,32,238
4550 DATA137,76,176,137,76,8,175
4560 DATA32,128,138,240,248,197,89
4570 DATA240,13,157,64,191,232,224
4580 DATA64,208,239,162,23,76,55
4590 DATA164,169,0,157,64,191,134
4600 DATA34,96,165,43,24,105,2
4610 DATA133,87,165,44,105,0,133
4620 DATA88,96,162,0,160,2,132
4630 DATA35,165,1,41,254,133,1
4640 DATA177,87,240,33,221,64,191
4650 DATA8,165,1,9,1,133,1
4660 DATA40,208,7,200,232,228,34
4670 DATA208,227,96,230,35,164,35
4680 DATA162,0,177,87,240,3,76
4690 DATA238,137,165,1,9,1,133
4700 DATA1,165,87,56,233,2,133
4710 DATA87,165,88,233,0,133,88
4720 DATA160,0,177,87,133,89,200
4730 DATA177,87,133,88,5,89,240
4740 DATA16,165,89,24,105,2,133
4750 DATA87,165,88,105,0,133,88
4760 DATA76,232,137,120,173,196,138
4770 DATA141,0,3,173,197,138,141
4780 DATA1,3,88,76,116,164,96
4790 DATA160,0,32,139,138,169,145
4800 DATA32,210,255,177,87,133,20
4810 DATA200,177,87,133,21,32,19
4820 DATA166,32,201,166,32,165,138
4830 DATA230,35,164,35,162,0,96
4840 DATA230,122,208,2,230,123,160
4850 DATA0,177,122,96,165,34,141
4860 DATA191,138,165,35,141,192,138
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4870 DATA165,87,141,193,138,165,88
4880 DATA141,194,138,165,252,141,195
4890 DATA138,96,173,191,138,133,34
4900 DATA173,192,138,133,35,173,193
4910 DATA138,133,87,173,194,138,133
4920 DATA88,173,195,138,133,252,96
4930 DATA0,0,0,0,0,0,0
4940 DATA169,0,133,10,32,212,225
4950 DATA169,0,133,185,165,45,56
4960 DATA233,2,170,165,46,233,0
4970 DATA168,165,10,32,213,255,32
4980 DATA51,165,165,45,164,46,56
4990 DATA233,2,133,87,152,233,0
5000 DATA133,88,160,0,177,87,208
5010 DATA27,200,177,87,208,22,165
5020 DATA87,24,105,2,133,45,133
5030 DATA47,133,49,165,88,105,0
5040 DATA133,46,133,48,133,50,96
5050 DATA160,0,177,87,133,89,200
5060 DATA177,87,133,88,165,89,133
5070 DATA87,76,242,138,240,24,32
5080 DATA107,169,165,20,141,74,139
5090 DATA165,21,141,75,139,169,76
5100 DATA141,4,3,169,139,141,5
5110 DATA3,96,169,201,141,4,3
5120 DATA169,129,141,5,3,96,10
5130 DATA0,173,0,2,201,48,144
5140 DATA10,201,58,176,6,169,1
5150 DATA133,2,208,4,169,0,133
5160 DATA2,32,201,129,165,2,208
5170 DATA1,96,192,5,208,1,96
5180 DATA173,74,139,24,101,20,170
5190 DATA173,75,139,101,21,134,99
5200 DATA133,98,162,144,56,152,72
5210 DATA32,73,188,32,223,189,133
5220 DATA251,132,252,160,0,177,251
5230 DATA240,6,153,119,2,200,208
5240 DATA246,200,169,32,153,119,2
5250 DATA132,198,104,168,96,32,212
5260 DATA225,169,0,133,185,166,43
5270 DATA164,44,32,213,255,176,33
5280 DATA134,45,134,47,134,49,132
5290 DATA46,132,48,132,50,169,13
5300 DATA32,210,255,169,0,133,157
5310 DATA141,216,139,32,94,166,32
5320 DATA142,166,76,174,167,76,249
5330 DATA224,0,32,61,140,165,95
5340 DATA166,96,133,251,134,252,32
5350 DATA19,166,165,95,166,96,144
5360 DATA10,160,1,177,95,240,4
5370 DATA170,136,177,95,133,122,134
5380 DATA123,165,251,56,229,122,170
5390 DATA165,252,229,123,168,176,30
5400 DATA138,24,101,45,133,45,152
5410 DATA101,46,133,46,160,0,177
5420 DATA122,145,251,200,208,249,230
5430 DATA123,230,252,165,46,197,252
5440 DATA176,239,32,51,165,165,45
5450 DATA166,46,24,105,2,133,45
5460 DATA144,1,232,134,46,32,89
5470 DATA166,76,116,164,32,121,0
5480 DATA240,16,144,17,201,171,208
5490 DATA10,165,43,133,95,165,44
5500 DATA133,96,208,18,76,8,175
5510 DATA32,107,169,32,19,166,32
5520 DATA121,0,240,12,201,171,208
5530 DATA238,32,115,0,32,107,169
5540 DATA208,230,165,20,5,21,208
5550 DATA6,169,255,133,20,133,21
5560 DATA96,32,107,169,165,20,141
5570 DATA244,140,165,21,141,245,140
5580 DATA32,253,174,32,107,169,165
5590 DATA20,141,246,140,165,21,141
5600 DATA247,140,32,142,166,32,168
5610 DATA140,76,81,141,32,142,166
5620 DATA32,174,140,76,5,141,169
5630 DATA181,160,140,208,4,169,199
5640 DATA160,140,76,30,171,42,42
5650 DATA42,42,32,80,65,83,83
5660 DATA32,49,32,42,42,42,42
5670 DATA13,0,13,42,42,42,42
5680 DATA32,80,65,83,83,32,50
5690 DATA32,42,42,42,42,13,0
5700 DATA13,85,78,68,69,70,73
5710 DATA78,69,68,32,0,32,73
5720 DATA78,32,79,76,68,32,76
5730 DATA73,78,69,32,0,70,0
5740 DATA10,0,0,0,43,8,131
5750 DATA164,2,1,0,137,138,141
5760 DATA167,32,70,141,160,0,177
5770 DATA122,141,248,140,200,177,122
5780 DATA141,249,140,173,244,140,200
5790 DATA145,122,173,245,140,200,145
5800 DATA122,24,173,244,140,109,246
5810 DATA140,141,244,140,173,245,140
5820 DATA109,247,140,141,245,140,173
5830 DATA249,140,240,10,133,123,173
5840 DATA248,140,133,122,76,8,141
5850 DATA76,116,164,230,122,208,2
5860 DATA230,123,160,0,177,122,96
5870 DATA32,70,141,32,70,141,208
5880 DATA3,76,159,140,165,122,141
5890 DATA250,140,165,123,141,251,140
5900 DATA32,70,141,32,70,141,32
5910 DATA70,141,201,0,240,222,201
5920 DATA238,240,41,201,34,240,26
5930 DATA170,16,238,162,4,221,0
5940 DATA141,240,34,202,208,248,201
5950 DATA203,208,224,32,115,0,201
5960 DATA164,208,220,240,18,32,70
5970 DATA141,240,183,201,34,240,206
5980 DATA208,245,32,70,141,201,1
5990 DATA208,197,169,46,32,210,255
6000 DATA32,115,0,144,3,76,126
6010 DATA142,165,122,141,248,140,165
6020 DATA123,141,249,140,160,0,177
6030 DATA122,200,201,48,144,4,201
6040 DATA58,144,245,136,136,140,254
6050 DATA140,165,122,208,2,198,123
6060 DATA198,122,32,115,0,32,107
6070 DATA169,32,136,142,173,250,140
6080 DATA133,122,173,251,140,133,123
6090 DATA32,70,141,133,20,32,70
6100 DATA141,133,21,162,0,32,70
6110 DATA141,72,165,122,205,248,140
6120 DATA208,7,165,123,205,249,140
6130 DATA240,7,104,157,0,2,232
6140 DATA208,231,104,160,0,185,0
6150 DATA1,240,7,157,0,2,200
6160 DATA232,208,244,140,255,140,173
6170 DATA254,140,24,101,122,133,122
6180 DATA165,123,105,0,133,123,32
6190 DATA70,141,157,0,2,240,3
6200 DATA232,208,245,138,24,105,5
6210 DATA133,11,173,2,3,141,252
6220 DATA140,173,3,3,141,253,140
6230 DATA169,92,141,2,3,169,142
6240 DATA141,3,3,164,11,76,164
6250 DATA164,173,252,140,141,2,3
6260 DATA173,253,140,141,3,3,206
6270 DATA255,140,173,255,140,24,109
6280 DATA248,140,133,122,173,249,140
6290 DATA105,0,133,123,32,115,0
6300 DATA201,44,240,3,76,111,141
6310 DATA76,167,141,32,142,166,173
6320 DATA244,140,133,99,173,245,140
6330 DATA133,98,32,70,141,32,70
6340 DATA141,208,65,169,157,32,210
6350 DATA255,169,32,32,210,255,169
6360 DATA218,160,140,32,30,171,165
6370 DATA21,166,20,32,205,189,169
6380 DATA230,160,140,32,30,171,173
6390 DATA250,140,133,251,173,251,140
6400 DATA133,252,160,1,177,251,170
6410 DATA200,177,251,32,205,189,169
6420 DATA13,32,210,255,169,255,133
6430 DATA99,133,98,48,14,32,70
6440 DATA141,197,20,208,16,32,70
6450 DATA141,197,21,208,12,162,144
6460 DATA56,32,73,188,76,223,189
6470 DATA32,70,141,165,99,24,109
6480 DATA246,140,133,99,165,98,109
6490 DATA247,140,133,98,32,70,141
6500 DATA208,251,240,135,76,113,168
6510 DATA76,8,175,76,8,175,76
6520 DATA8,175,76,8,175,76,8
6530 DATA175,76,8,175,76,8,175
6540 DATA76,8,175,76,8,175,76
6550 DATA8,175,76,8,175,76,8
6560 DATA175,76,8,175,76,8,175
6570 DATA76,8,175,76,8,175,76
6580 DATA8,175,76,8,175,76,8
6590 DATA175,76,8,175,76,8,175
6600 DATA76,8,175,0,255,0,255,999
```

DELETE LISTING

```
1000 DELETE JSR DELE05 ;GET DELETE RAN
GE
1010  LDA $5F ;GET START OF DELETE
1020  LDX $5F+1 ;MEMORY POINTER
1030  STA $FB ;STORE IT
1040  STX $FB+1
1050  JSR $A613 ;FIND ADDRESS OF
1060  LDA $5F ;END OF DELETE
1070  LDX $5F+1
1080  BCC DELE01
1090  LDY #$01
1100  LDA ($5F),Y
1110  BEQ DELE01
1120  TAX
1130  DEY
1140  LDA ($5F),Y
1150 ;
1160 ;.A ,.X HOLD THE POINTER TO THE E
ND
1170 ; OF DELETE RANGE.
1180 ;$FC,$FB HOLD THE POINTER TO THE
1190 ; START OF DELETE RANGE.
1200 ;
1210 DELE01 STA $7A ;STORE AWAY END
1220  STX $7A+1 ;OF DELETE POINTER
1230  LDA $FB
1240  SEC
1250  SBC $7A ;SET VARIABLE POINTER
1260  TAX ;TO END OF PROGRAM AFTER
1270  LDA $FB+1 ;DELETE
1280  SBC $7A+1
1290  TAY
1300  BCS DELE03
1310  TXA
1320  CLC
1330  ADC $2D
1340  STA $2D
1350  TYA
1360  ADC $2D+1
1370  STA $2D+1
1380  LDY #$00
1390 DELE02 LDA ($7A),Y ;GET BYTE
1400  STA ($FB),Y ;MOVE IT DOWN
1410  INY
1420  BNE DELE02 ;DO FULL PAGE
1430  INC $7A+1 ;INCREMENT HI BYTE
1440  INC $FB+1 ;POINTERS
1450  LDA $2D+1 ;DONE LENGTH?
1460  CMP $FB+1
1470  BCS DELE02 ;NOT YET
1480 DELE03 JSR $A533 ;RE-CHAIN PROG
1490  LDA $2D
1500  LDX $2E
1510  CLC
1520  ADC #$02
1530  STA $2D ;SET VAR POINTERS
1540  BCC DELE04
1550  INX
1560 DELE04 STX $2D+1
1570  JSR $A659 ;PERFORM 'CLR'
1580  JMP $A474 ;'READY.'
1590 ;
1600 ;GET RANGE FOR DELETE
1610 ;
1620 DELE05 JSR $0079 ;GET CURRENT CHA
R
1630  BEQ DELE06 ;NO RANGE, ERROR
1640  BCC DELE07 ;IS A NUMBER
1650  CMP #$AB ;IS IT '-'?
1660  BNE DELE06 ;NO, ERROR
1670  LDA $2B ;SET START ADDRESS OF
1680  STA $5F ;DELETE TO START
1690  LDA $2C ;OF PROGRAM
1700  STA $5F+1
1710  BNE DELE08 ;ALWAYS
1720 DELE06 JMP $AF08 ;OUTPUT SYNTAX E
RROR
1730 DELE07 JSR $A96B ;GET NUMBER
1740  JSR $A613 ;FIND ADDRESS OF LINE
1750  JSR $0079 ;SECOND VALUE?
1760  BEQ DELE09 ;NO
1770  CMP #$AB ;IS IT '-'?
1780  BNE DELE06 ;NO, ERROR
1790 DELE08 JSR $0073 ;GET NEXT CHAR
1800  JSR $A96B ;GET NUMBER
1810  BNE DELE06 ;NOT END OF INPUT
1820 DELE09 LDA $14 ;IS SECOND LINE ZE
RO?
1830  ORA $14+1
1840  BNE DELE10 ;NO
1850  LDA #$FF ;SET TO MAX LINE#
1860  STA $14
1870  STA $14+1
1880 DELE10 RTS ;RANGE DONE
1890 .END
```

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# TOY TROUBLE

**The local toyshop was never as bad as the one in this game by F. Tout.**

IT IS LATE AT NIGHT. A strange force has taken control of the local toy factory. Peaceful toys have been turned into lurking monsters.

Yet again, equipped with a bi-directional laser, you are mankind's last hope. Your task is to destroy the toys while avoiding the Bonio's that fly around the factory.

Your laser can fire up or down and you are given three lives. The laser is controlled by a Joystick in port two of your C64 laser pack.

Push Left to go left
Right to move right
Forward to scroll top sector
Back to scroll bottom sector
Forward and fire to fire up
Back and fire to fire down

## Program details

### Program 1

| | |
|---|---|
| 0 | sets screen and border colours |
| 5 | reads machine code |
| 10 | reads graphics |
| 15 | reads sprites |
| 20 | reads data |

### Program 2

| | |
|---|---|
| 10 | sets up multi colour mode |
| 25-30 | set up sound registers |
| 33-39 | set up sprite positions |
| 99-120 | print screen |
| 200-205 | sound effects |
| 500-505 | print score |
| 1000-1095 | title page |
| 1998 | calls IRQ and sets speed |
| 2000-2010 | main loop |
| 3000 | hits toy |
| 4000 | cleared toys |
| 5000-5016 | hit Bonio |
| 6000-6050 | high score table |
| 7000 | game over |

V — Vic chip
S1, S2, S3 — sound registers
S — score
HI — high score
LI — lives
QQ — start of machine code

## Program Listing 1

```
0 PRINT"[CLEAR][YELLOW]";:PRINTTAB
(14)"PLEASE WAIT":POKE53280,8:POKE
53281,9
5 FORT=49152TO50443:READA:POKET,A:
NEXT:SYS49376
10 FORT=0TO207:READA:POKE12808+T,A
:NEXT
15 FORT=13056TO13631:READA:POKET,A
:NEXT
20 DATA169,40,133,251,169,4,133,25
2,169,,133,254,160,
22 DATA177,251,133,253,160,1,177,2
51,136,145,251,200,200,192
24 DATA40,208,245,160,39,165,253,1
45,251,165,251,105,39,133
26 DATA251,144,2,230,252,230,254,1
66,254,224,11,208,213,96
28 DATA169,40,133,251,169,4,133,25
2,169,,133,254,160,39
30 DATA177,251,133,253,160,38,177,
251,200,145,251,136,136,192
32 DATA255,208,245,160,,165,253,14
5,251,165,251,105,39,133
34 DATA251,144,2,230,252,230,254,1
66,254,224,11,208,213,96
36 DATA169,8,133,251,169,6,133,252
,169,,133,254,160,
38 DATA177,251,133,253,160,1,177,2
51,136,145,251,200,200,192
40 DATA40,208,245,160,39,165,253,1
45,251,165,251,105,39,133
42 DATA251,144,2,230,252,230,254,1
66,254,224,11,208,213,96
44 DATA169,8,133,251,169,6,133,252
,169,,133,254,160,39
46 DATA177,251,133,253,160,38,177,
251,200,145,251,136,136,192
48 DATA255,208,245,160,,165,253,14
5,251,165,251,105,39,133
50 DATA251,144,2,230,252,230,254,1
66,254,224,11,208,213,96
52 DATA169,,133,163,169,48,133,164
,169,,133,165,169,208
54 DATA133,166,173,14,220,41,254,1
41,14,220,165,1,41,251
56 DATA133,1,160,255,200,177,165,1
45,163,192,255,208,247,166
58 DATA164,232,134,164,164,166,200
,132,166,228,52,208,231,165
60 DATA1,9,4,133,1,173,14,220,9,1,
141,14,220,173
62 DATA24,208,41,240,105,12,141,24
,208,96,212,169,10,141
64 DATA 101, 212, 169, 173, 0, 208
, 201, 75, 240, 3, 206, 0, 208, 96
66 DATA96,1,141,188,2,238,15,208,2
38,,208,96,173,
68 DATA208,201,254,240,3,238,,208,
96,96,188,2,201,
70 DATA240,23,173,,208,201,,240,4,
```

## Program Listing 1 (cont.)

```
206..208.96.169
72 DATA.141.188.2.206.16.208.206..
208.96.173..208
74 DATA201.32.240.3.206,.208.96.17
3.168,2,201.1,240
76 DATA5.201.2.240,5.96.32,56.192.
96,32,.192.96
78 DATA173.169.2.201,1.240,5,201.2
.240.5.96.32,112
80 DATA192.96.32.168.192.96.173.2.
208.201.255.240.1.96
82 DATA238.16.208.238.16.208.238.2
.208.96.173.2.208,201
84 DATA.240..96.206.16.208.206.16.
208,206.2,208.96
86 DATA173.3.208,201,61.240.35,201
.60.240,31,206.3,208
88 DATA206.3,208.32.16.194.96.173,
3.208.201.225,240,14
90 DATA201,226.240.10,238.3,208.23
8.3.208.32.16.194.96
92 DATA173,.208.141.2,208.173.1,20
8.141.3.208.169.
94 DATA141.252.3.141.253,3,141,18,
212.96.169.64.141.18
96 DATA212.169.1.141,19.212.173.18
.208.141.15.212.169.21
98 DATA141,18.212,96.169.16.141.11
.212.169.121.141.12.212
100 DATA173.4.220.141.8.212.169.13
5.141.11.212.96.173.252
102 DATA3.201.1,240.1,96.32.206.19
3.96.173.253.3.201
104 DATA1,240.1.96.32.227.193.96.1
73.254.3.201..240
106 DATA5.201.1,240.5,96.32.150.19
3.96.32.130.193.96
108 DATA173..220.201.123.208.20.32
.55.193.32.38.194.169
110 DATA1.141.168:2.169.2.141.169.
2.234.234.234.96.201
112 DATA119.208.20.32.78.193.32.38
.194.169.1.141.169.2
114 DATA169.2.141.168.2.234.234.23
4.96.201.126.208.9.169
116 DATA1.141.254.3.234.234.234.96
.201.125.208.9.169.
118 DATA141.254.3.234.234.234.96.2
01.110.208.9.169.1.141
120 DATA252.3.32.244.194.96.201.10
9.208.9.169.1.141.253
122 DATA3.32.238.194.96.96.252.3.2
01..240.8.173.253
124 DATA3,201,,240,1,96,173,,208,1
41,2,208,173,1
126 DATA208,141,3,208,234,234,234,
96,169,,141,252,3,96
128 DATA169,,141,253,3,96,173,252,
3,201,,240,1,96
130 DATA173,253,3,201,,240,1,96,17
3,,208,141,2,208
132 DATA173,1,208,141,3,208,234,23
4,234.96,96,169,128,141
134 DATA4,212,169,11,141,5,212,169
,10,141,1,212,169,135
136 DATA141,4,212,96,,255,1,47,,36
,10,52,,36
138 DATA36,32,223,,107,11,,255,,25
5,,255,,32
140 DATA223,255,,255,36,255,,32,32
,170,193,32,188,193
142 DATA32,60,194,32,72,194,32,250
,194,32,104,194,32,75
144 DATA196,32,13,196,32,102,196,7
6,49,234,120,169,80,141
146 DATA20,3,169,195,141,21,3,88,9
6,120,169,49,141,20
148 DATA3,169,234,141,21,3,88,96,1
60,5,185,8,4,24
150 DATA105,1,153,8,4,201,58,144,8
,169,48,153,8,4
152 DATA136,208,235,202,96,232,194
,96,32,27,195,32,136,195
154 DATA234,234,234,96,32,,192,32,
168,192,96,16,194,32
156 DATA38,194,32,27,195,238,32,20
8,238,32,208,96,238,188
158 DATA2,76,174,195,169,,141,188,
2,173,189,2,201,1
160 DATA240,6,238,189,2,76,174,195
,169,,141,188,2,141
162 DATA189,2,96,162,,189,4,208,25
4,4,208,162,,189
164 DATA5,208,201,140,240,9,254,5,
208,232,232,224,10,208
166 DATA240,169,,157,5,208,173,18,
208,157,4,208,96,96
168 DATA96,173,190,2,201,10,240,4,
238,190,2,96,169,
170 DATA141,190,2,32,33,196,96,173
,250,7,201,212,240,7
172 DATA238,250,7,32,56,196,96,169
,206,141,250,7,32,56
174 DATA196,96,173,250,7,141,251,7
,141,252,7,141,253,7
176 DATA141,254,7,141,255,7,96,173
```

## Program Listing 1 (cont.)

```
,191,2,201,3,240,4
178 DATA238,191,2,96,169,,141,191,
2,32,237,195,96,32
180 DATA164,195,173,16,208,96,173,
30,208,201,6,208,12,169
182 DATA,141,5,208,32,95,196,141,4
,208,96,201,10,208
184 DATA12,169,,141,7,208,32,95,19
6,141,6,208,96,201
186 DATA18,208,12,169,,141,9,208,3
2,95,196,141,8,208
188 DATA96,201,34,208,12,169,,141,
11,208,32,95,196,141
190 DATA10,208,96,201,66,208,12,16
9,,141,13,208,32,95
192 DATA196,141,12,208,96,201,130,
208,12,169,,141,15,208
194 DATA32,95,196,141,14,208,96,20
1,5,240,56,201,9,240
196 DATA52,201,17,240,48,201,33,24
0,44,201,65,240,40,201
198 DATA129,240,36,201,7,240,32,20
1,11,240,28,201,19,240
200 DATA24,201,35,240,20,201,67,24
0,16,201,131,240,12,169
202 DATA,141,30,208,141,208,2,234,
234,234,96,169,1,141
204 DATA208,2,234,96
300 DATA85,101,25,26,6,5,1,1,85,85
,84,84,80,80
302 DATA64,64,2,8,8,2,1,5,25,105,1
28,32,32,128
304 DATA64,80,84,85,15,63,63,243,2
43,243,255,63,240,252
306 DATA252,207,207,207,255,252,62
,62,62,63,60,12,15,3
308 DATA62,62,62,63,60,48,240,192,
86,86,90,90,106,111
310 DATA175,175,149,149,165,165,16
9,249,250,250,175,175,111,106
312 DATA90,90,86,86,250,250,249,16
9,165,165,149,149,,
314 DATA5,22,89,89,101,101,,,80,14
8,101,101,89,89
316 DATA89,89,101,101,148,80,,,101
,101,89,89,22,5
318 DATA,,20,21,81,81,85,21,21,5,2
0,84,69,69
320 DATA85,84,84,80,4,5,1,1,1,,,,1
6,80
322 DATA64,64,64,,,,,,231,219,,,
324 DATA,,16,16,,,,,,,,,8,8
326 DATA,,,12,12,,,,,85,85,85,85
328 DATA85,85,85,85,170,170,170,17
0,170,170,170,170
400 DATA96,,6,96,90,6,49,24,140,26
,90,88,14,60
402 DATA112,7,24,224,3,255,192,49,
231,140,120,90,30,255
404 DATA255,255,,,,255,255,255,120
,90,30,49,231,140
406 DATA3,255,192,7,24,224,12,60,4
8,28,90,88,50,24
408 DATA140,96,90,6,96,,6,127,,,,,
,
410 DATA,,,,,,,,,,,,,12
412 DATA,,12,,,12,,,12,,,12,,
414 DATA12,,,12,,,,,,,,,,
416 DATA,,,,,,,,,,,,,,
418 DATA,127,,,,,,,,,,,,,
420 DATA248,,31,254,,127,127,129,2
54,63,255,252,31,127
422 DATA248,31,143,248,31,249,248,
63,254,124,127,255,254,255
424 DATA129,255,254,,127,248,,31,,
,,,,
426 DATA,,,,,,,,,240,,,,
428 DATA,,,,,,,,124,,62,127,,254
430 DATA63,195,252,63,255,248,79,1
27,240,79,143,240,79,249
432 DATA240,63,254,120,63,255,252,
127,195,254,127,,254,124
434 DATA,62,,,,,,,,,,,,,
436 DATA,,,240,,,,,,,,,,
438 DATA,,28,,248,31,3,248,15,207,
240,15,255,224
440 DATA19,255,224,19,207,192,19,2
49,192,15,255,192,15,255
442 DATA224,31,255,248,31,195,248,
31,,248,,,,
444 DATA,,,,,,,,,,,240,,
446 DATA,,,,,,,,,,7,3,224,15
448 DATA207,224,23,255,224,19,255,
192 49,255,128,32,239,128
450 DATA32,251,128,49,255,128,19,2
55,192,23,255,224,15,255
452 DATA224,7,195,224,,,,,,,,,,
454 DATA,,,,,240,,,,,,,,
456 DATA,,,,,219,,1,127,192,2,63,1
92,4
458 DATA31,128,4,31,129,12,31,128,
8,31,,12,31,
460 DATA4,63,128,6,63,128,3,127,12
8,1,254,,,
462 DATA,,,,,,,,,,,,,,240
464 DATA,,,,,,,,,,,,,,124
```

## Program Listing 1 (cont.)

```
466 DATA,,138,,1,7,,2,7,,2,3,,2
468 DATA3,,2,3,,3,3,,1,7,,1,135,
470 DATA,142,,,124,,,,,,,,,
472 DATA,,,,,,,240,,,,,,
474 DATA,,,,,,,60,,,102,,,203
476 DATA,,149,,1,169,128,1,149,128
,1,169,128,1
478 DATA149,128,,169,,,195,,,102,,
,60,
480 DATA,,,,,,,,,,,,,,,,,32
500 POKE198,2:POKE631,13:LOAD
```

## Program Listing 2

```
10 V=53248:POKEV+22,PEEK(V+22)OR16
:POKEV+24,29:POKEV+32,0:POKEV+33,0
:POKEV+34,2
20 POKEV+35,10
25 S1=54276:S2=54277:S3=54273:SU=S
1-1:POKES3+14,15:POKESU,78
30 POKES1+20,31:POKES1+19,245:GOTO
1000
33 G=10:FORT=4TO14STEP2:POKEV+T,0:
POKEV+T+1,G:G=G+31:NEXT
35 POKEV+21,255:POKEV,0:POKEV+1,13
9:POKE2040,204:POKE2041,205:POKEV+
39,3
37 POKEV+40,3:POKEV+35,13:POKEV+34
,2:POKESU+7,8:POKESU+14,18
39 FORT=2042TO2047:POKET,206:NEXT
40 POKE1020,0:POKE1021,0:POKE820,0
:POKEV+30,0
45 G=10:FORT=5TO15STEP2:POKEV+T,G:
G=G+27:NEXT
64 POKE54275+14,20
99 IFDD=1THENGOSUB501:GOTO505
100 A$="[c 8][s C][s D][s E][s F][
s I][s J][s M][s N][s Q][s R][LEFT
][LEFT][LEFT
][LEFT][LEFT][LEFT][LEFT][LEFT][LE
FT][LEFT][DOWN][s A][s B][s G][s H
][s K][s L][
s P][s O][s S][s T][UP]":DD=1
102 B$="[c 7][s U]":DO$="[DOWN]":P
RINT"[HOME]";:FORT=0TO11:PRINTDO$;
:NEXT:PRINT"
[c 7][s Y]";:FORT=0TO37:PRINTB$;
103 NEXT:PRINT"[s Y]";
104 PRINT"[DOWN]";:FORTT=0TO4:FORT
=0TO3:PRINTA$;:GOSUB205:NEXTT:PRIN
T"[DOWN]";:N
EXTTT:PRINT"[HOME][WHITE]"
```

## Program Listing 2 (cont.)

```
105 A=1064:B=420:POKES1,0:POKES2,3
1
106 FORI=0TO80STEP2:POKEA+RND(1)*B
,86:GOSUB200:NEXT:POKES1,64
107 FORI=80TO160STEP2:POKEA+RND(1)
*B,87:GOSUB200:NEXT:POKES1,64
108 FORI=160TO240STEP2:POKEA+RND(1
)*B,46:GOSUB200:NEXT
110 IFCL=1THENGOSUB501:GOTO600
112 GOSUB500
120 GOTO600
200 POKES3,I:POKES1,71:RETURN
205 POKES1,128:POKES2,12:POKES3,50
:POKES1,135:RETURN
500 PRINT"[HOME][RED]   SCORE [CYA
N]000000 [RED]LI [CYAN]  [RED]HIGH
 SCORE [CYAN
]       [c 2]":DD=1
501 PRINT"[HOME][CYAN]";:PRINTTAB(
18);LI:TAB(33):HI(1)
505 IFCL=1THENRETURN
600 FORT=175TO25STEP-1:POKES3,T:POK
ES1,135:POKEV,177-T:NEXT:GOTO1998
1000 PRINT"[CLEAR][DOWN][DOWN][DOW
N][DOWN][DOWN][c 8]":POKE53283,10:
POKEV+21,0:D
D=0
1030 PRINT"          [s I][s L][s K]
[s J]          [s M][s N]
1035 PRINT"          [s K]    [s E][
s F]        [s P][s O]
1040 PRINT"      [s C][s D] [s I]
  [s G][s H] [s K][s L][s K] [s L]
   [s L][s K
][s L] [s L][s K][s L] [s Q][s R]
1045 PRINT"      [s A][s B] [s K][s
 L][s K][s L][s K][s L][s K] [s L]
 [s L] [s K]
    [s K]   [s L]  [s S][s T]
1050 PRINT"                 [s L] [s
K][s L][s K] [s L]     [s L]   [s K
]
1055 PRINT"      [s U][s U][s U][s
 U][s U][s U][s U][s U][s U][s U][
s U][s U][s
U][s U][s U][s U][s U][s U][s U][s
 U][s U][s U][s U][s U][s U][s U][
s U]
1060 PRINT"          [s K][s L][s K]
[s L][s K][s L][s K] [s L]    [s K]
[s L][s K] [
s K][s L][s K]  [s L]
1080 PRINT"[GREEN][DOWN][DOWN] BY
FRANK TOUT : 1985 : SPACE TO PLAY.
":Q=53282:PO
```

## Program Listing 2 (cont.)

```
KE198,0
1090 GETA$:FORT=1TO15:POKEQ,T:NEXT
:IFA$<>" "THEN1090
1095 DD=0:LI=3:S=0:PRINT"[CLEAR]";
:POKE50255,3:PU=0:GOTO33
1998 SYS50030:POKE56325,18:QQ=4974
8:U=V+2:R=V+3:H=862
2000 SYSQQ:J=INT(PEEK(U)/8)+INT(PE
EK(R)/8)*40+H:JJ=PEEK(J)
2002 IFJJ=65ORJJ=71ORJJ=75ORJJ=80O
RJJ=83THENGOSUB3000
2004 IFPU=100THEN4000
2006 IFPEEK(720)=1THEN5000
2010 GOTO2000
3000 POKEJ,32:POKEJ+1,32:POKEJ-39,
32:POKEJ-40,32:PU=PU+1:SYS50084:RE
TURN
4000 SYS50043:Q=53281:FORT=0TO255:
POKEQ,T:NEXT:POKEQ,0
4002 Q=49152:FORT=0TO255:SYSQ:NEXT
:PU=0:IFPEEK(50255)>0THENPOKE50255
,PEEK(50255)
-1
4004 FORT=0TO200*3-PEEK(50255):SYS
50084:NEXT:GOSUB5100:CL=1
4006 DD=0:POKES3+14,10:PU=0:GOTO33
5000 SYS50043:POKES1,128:POKES1+7,
128:POKES1+14,128
5002 POKE56325,20:POKES2,15:POKES2
+7,15:POKES2+14,31:FORT=75TO1STEP-
1:SYS50094
5004 POKES3,T:POKES3+7,T:POKES3+14
,T:POKES1,129:POKES1+7,129:POKES1+
14,135:NEXT
5006 SYS50043
5012 POKES1,64:POKES2,47:FORT=255T
01STEP-2:POKES3,T:POKES1,65:NEXT
5014 GOSUB5100:LI=LI-1:IFLI<1THEN7
000
5016 POKEV+21,0:GOTO33
5100 S=0:FORI=0TO5:SC=PEEK(1033+I)
-48:S=S*10:S=S+SC:NEXTI:RETURN
6000 POKEV+21,0:IFS<=HI(5)THEN6006
6003 PRINT"[CLEAR][RIGHT][DOWN][DO
WN][DOWN][DOWN][DOWN][BLUE]HIGH [R
ED]SCORE[PUR
PLE] CHAMP!!!":INPUT"[DOWN][DOWN]
 [DOWN][YELLOW]PLEASE[CYAN] STATE[
PURPLE] YOU
[GREEN]NAME[YELLOW]";NA$
6005 HI$(5)=NA$:HI(5)=S
6006 FORI=5TO2STEP-1:FORJ=2TOI
6007 IFHI(J)<HI(J-1)THEN6020
6009 T=HI(J-1):NA$=HI$(J-1):HI(J-1
)=HI(J):HI$(J-1)=HI$(J)
6010 HI(J)=T:HI$(J)=NA$
6020 NEXTJ,I
6022 PRINT"[CLEAR]";:Z$="[c 8][s Y
][s Z][s Y][s Z][s Y][s Z][s Y][s
Z][s Y][s Z]
[s Y][s Z][s Y][s Z][s Y][s Z][s Y
][s Z][s Y][s Z][s Y][s Z][s Y][s
Z][s Y][s Z]
[s Y][s Z][s Y][s Z][s Y][s Z][s Y
][s Z][s Y][s Z][s Y][s Z][s Y][s
Z][s Y][s Z]
[s Y][s Z][s Y][s Z][s Y][YELLOW]"
6023 FORT=0TO22:PRINTZ$;:NEXT:X$="
[RIGHT][RIGHT][RIGHT][RIGHT][RIGHT
][RIGHT][RIG
HT][RIGHT][RIGHT][RIGHT]
              [RIGHT][RIGHT][RIGHT][RIG
HT][RIGHT][R
IGHT][RIGHT][RIGHT][RIGHT][RIGHT][
RIGHT]"
6025 PRINT"[HOME][DOWN][DOWN][DOWN
][DOWN][DOWN][DOWN][DOWN]";:FORT=0
TO9:PRINTX$;
:NEXT
6029 PRINT"[HOME][RIGHT][RIGHT][RI
GHT][RIGHT][RIGHT][RIGHT][RIGHT][R
IGHT][RIGHT]
[RIGHT][RIGHT][DOWN][DOWN][DOWN][D
OWN][DOWN][DOWN][DOWN][RED] HI-SCO
RES "
6030 REM"PRINT      [CYAN]
[BLUE]"
6035 FORI=1TO5:PRINTTAB(10)I;"[RED
] [PURPLE]"HI(I)TAB(22)LEFT$(HI$(I
),7)"[BLUE]"
:NEXT
6050 Q=53282:FORT=0TO120:POKEQ,T:P
OKEQ+1,T+1:FORTT=0TO35:NEXTTT,T:GO
TO1000
7000 W$="[HOME][DOWN][DOWN][DOWN][
DOWN][RIGHT][RIGHT][RIGHT][RIGHT][
RIGHT][RIGHT
][RIGHT][RIGHT][RIGHT][RIGHT][RIGH
T][RIGHT][RIGHT][RIGHT][RIGHT][RED
]GAME  [YELL
OW]OVER":Y$="[HOME][DOWN][DOWN][DO
WN][DOWN][RIGHT][RIGHT][RIGHT][RIG
HT][RIGHT][R
IGHT][RIGHT][RIGHT][RIGHT][RIGHT][
RIGHT][RIGHT][RIGHT][RIGHT][RIGHT]
 "
7002 POKES1,16:POKES2,31:FORT=254T
O0STEP-2:PRINTW$:PRINTY$:POKES3,T:
POKES1,71
7004 NEXT:GOTO6000
```

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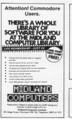

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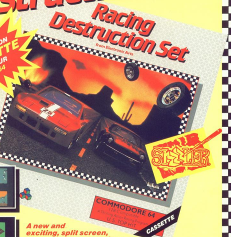
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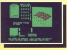

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FOR THE COMMODORE 64

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